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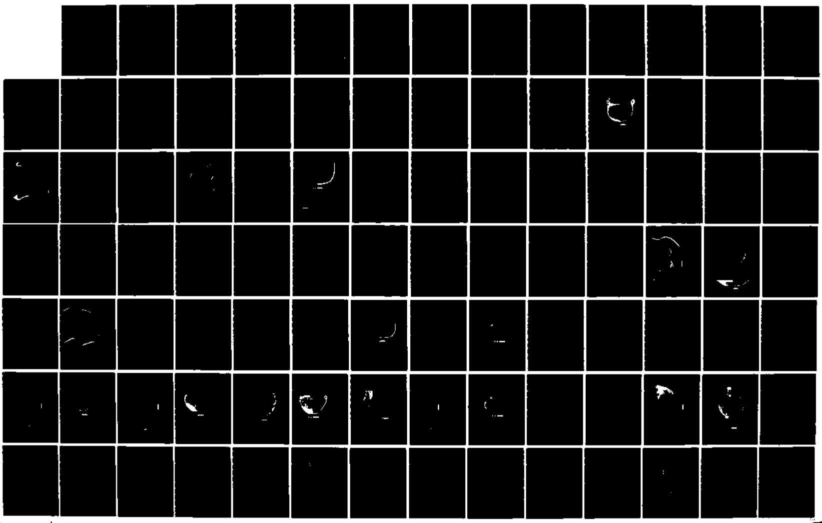

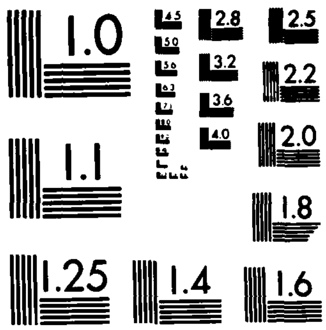

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Volume II

of Prehistoric Agricultural Communities in West Central Alabama

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The excavations conducted in the Lubbub Archaeological Locality examined in detail a Mississippian period settlement located on the Tombigbee River, in Pickens County, Alabama. Work at the site was carried out by the University of Michigan between 1978 and 1979. Nearly 25,000 square meters of the site were excavated, uncovering a mound, Mississippian house sites, features, and post-holes. Detailed analyses were carried out on the lithic, ceramic, faunal, floral and human skeletal materials recovered from the site. Site community patterns

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20. are described and compared to other Mississippian period sites in Alabama.

STUDIES OF MATERIAL REMAINS FROM THE LUBBUB CREEK ARCHAEOLOGICAL LOCALITY

Volume II
of Prehistoric Agricultural Communities
in West Central Alabama

Investigations conducted by the University of Michigan, Ann Arbor, Michigan, under an agreement with the Heritage, Conservation, and Recreation Service, Interagency Archeological Services -- Atlanta, with funds supplied by the U.S. Army Corps of Engineers, Mobile District, in partial fulfillment of Contract Numbers C5861(79) and C5970(79). Christopher S. Peebles, Editor. 1983.

If I could do it, I'd do no writing
at all here. It would be photographs; the
rest would be fragments of cloth, bits of
cotton, lumps of earth, records of speech,
pieces of wood and earth, plates of food...
(Let Us Now Praise Famous Men, James
Agee and Walker Evans, p.12)

PREFACE

La Rochefoucauld once remarked that if hard work was not the same as genius, it was certainly a good substitute. Both these elements are reflected in the chapters that comprise this volume. The papers by Gloria Caddell, Cyril Baxter Mann, Jr., Mary Lucas Powell, Susan Scott, and Ann Woodrick are the products of months of very hard work, during which time they each pushed beyond the confines of their formal training, taught themselves new skills, and tested the limits of their abilities as scholars and scientists. I am proud to have had a small role in the development of each of these chapters: as editor, as keeper of the data banks, and as translator of statistical and other numerical techniques.

Whereas Volume I carries the burden of presentation of the fieldwork, features, culture history, and the notion of temporally bounded, archaeologically defined communities, Volume II presents the analyses of the material remains recovered in the Lubbub Creek Archaeological Locality. Volume I establishes the context; Volume II establishes the content. Volume III presents the raw data that lie behind both.

Tuscaloosa,
Alabama
March 1981

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blage.

d Rim

A folded rim is formed when the clay of the upper area of the vessel wall ck is bent 180 degrees and pressed flat against the supporting wall. action results in a wall thickness which is double the thickness of the nal wall. It is possible to achieve this thickened rim by the cation of an additional coil on the exterior vessel wall at the lip, but cross-section examined showed this was not the case. Instead, the r technique was used in all cases of folded rims. The cross-sections of herds showed that the rims were actually folded. At the point where the nal lip joined the vessel wall, it was usually smoothed so that there was y a gradual thickening. The earlier, Woodland period, folded rims of the were not smoothed, and there was an abrupt change in thickness between olded rim and the vessel wall on these vessels.

d Flattened Rim

In the case of the folded and flattened rims, the thickening effect in rim area is achieved by either of the two methods described under "folded ' The difference between folded flattened rims and folded rims is a ological one. Where the lip of the folded rim remains round, the lip on olded flattened rim (Figure 47C) is either modified by removal of the d area of the lip by cutting (S.E. van der Leeuw, personal communication) s flattened by hand while the clay was still in a very plastic state. In rior instance the curved lip actually is removed, leaving a flat or led surface. When the lip is flattened by hand, the surface is not as ed as when cut. The lip is more rounded when formed by hand, but the cut ces form near right-angles which are defined clearly.

es

Handles were noted as being present or absent for general numerical ulations without regard to specific handle attributes. The handle butes are dealt with later in the analysis under "handle metrics."

que Neck Fillets

Neck fillets found in the assemblage were thin coils of clay used to form er false handles (Figure 4a-f) or designs around the upper surface areas jar forms. These designs were confined to the area between the upper l shoulder and the lip. In the "false handle" form the strips were round oss-section but the ends of the strips were flattened to allow a larger ing area. When the strips were applied for decoration, the entire length e strips were pressed to be triangular in cross-section. This shaping ably occurred as the strips were applied. The strips were oriented both ically (Figure 4e-f) and diagonally.

Because of the few sherds which had neck fillets, a seriation of these d not be attempted. As more data become available, however, a ological ordering of these attributes should be possible, and they should late in the Mississippian period.

Bottles

The bottle category describes a globular or subglobular vessel body which is embellished with a vertical neck, the height of which is usually equal to one-quarter of the vessel's overall height. The only bottle form which was not included within the standard, subglobular bottle form was the slender ovoid bottle. Because of this vessels's elongated shape, it was determined that if sherds from this form were present, it could be identified.

Most of the bottles from the Lubbub Creek Archaeological Locality were subglobular (Figure 1D-F). As defined by Steponaitis (1980:119), "A subglobular bottle is characterized by a globular, ellipsoidal, or wide ovoid body, with the point of vertical tangency situated no higher than midway up the body's height." Bottles with simple bases were most common in the Lubbub Creek collection, but there were also occurrences of the pedestal base (Figure 1D) and the slab base (Figure 1E).

The slender ovoid bottle (Figure 1C) is described by Steponaitis as "a bottle which has an ovoid 'teardrop' body..." (Steponaitis 1980:119). The difference between neck diameter and maximum body diameter is usually not great. This gives the vessel form an appearance very similar to the jar form found in the coarse shell tempered types. The slender ovoid bottle form usually has a pedestal base which is common only on bottle forms in the Lubbub Creek Archaeological Locality.

When a sherd exhibited enough attributes to establish it as being a bottle fragment, but not enough to distinguish the particular bottle shape, the sherd was classified as a miscellaneous bottle.

SECONDARY SHAPE FEATURES

In the realms of ceramic modification, secondary features elaborate on the basic vessel forms rather than change them. Variation ranges from the single occurrence "village idiot ware" to standardized decorative elements. The seventeen secondary shape features chosen for this attribute analysis were chosen in the hope of producing a finer chronological seriation and classification of the Mississippian assemblages in the Lubbub Creek Archaeological Locality. These attributes fall both in the realms of utilitarian modifications, such as downturned lugs, and decorative modifications, such as body indentations, which appear to add only to the vessel's aesthetic appeal.

Downturned Lugs

A downturned lug is a handle formed by a projection of clay which extends downward from the vessel's rim area. This projection does not intersect the vessel wall at its maximum point of extension. Examples of this handle-form found at the Lubbub Creek Archaeological Locality were of two kinds: very thick lugs (Figure 3A-B) which are formed structurally for utilitarian purposes, and small thin flat downturned lugs which probably served as a decorative addition to the vessel. The latter appeared too thin to have been used independently as handles. It is possible, however, for a thin lug to be used as a handle when additional handles of like construction are used as well, but no evidence for multiple thin lugs was noted in the Lubbub Creek

Flaring rim bowls are distinguished by their outward spreading rims ɪure 1H-I). Usually they have a subglobular body, whose curvature from : to point of inflection may or may not reach vertical tangency. The ıor agrees with Steponaitis (1980) that a distinction should be made ɪeen those vessels which do (Figure 1H) and those which do not (Figure 1I) ·h vertical tangency. Steponaitis (1980:121) stated that: "Bowls which : a point of vertical tangency on their body are referred to as 'deep' and ·e which lack a point of vertical tangency are designated as 'shallow'."

Outslanting bowls (Figure 1J) have walls "which slant outward at an angle ıter than 20 degrees from vertical tangency" (Steponaitis 1980:121). It ıld be stressed that the walls of the vessel should be straight rather than ɪed in the movement from the base to the lip.

Pedestalled bowls usually have a subglobular to globular body shape ɪure 1K) resting on a round hollow support. The support, or pedestalled ɛ, could have been formed by pressing clay into a small cup or small slanting bowl. The shape of this mold would determine the shape of the ished support or, as named, the "pedestalled base" (S.E. van der Leeuw, endix to this chapter).

Short neck bowls (Figure 1M) are hard to distinguish from those of ːless jars when only the upper body sherds are present. The difference ween the two forms is that short neck bowls reach vertical tangency before actual modification of the end point which becomes the "short neck" for ch this form is named. This vessel form is described as having "a globular body, a restricted *orifice, and a short vertical neck*" eponaitis 1980:121-122). When dealing with ceramic samples which consist nly of sherds rather than complete vessels, the short neck bowls and the kless jar forms will always be confused unless a standard of vessel vatures is established for all basic vessel shapes. Such a measure would e to deal with height versus width of a vessel, degree of rim modification, ght of rim above shoulder, and points of differentiation between a rim ification and a prepared neck.

Simple bowls (Figure 1N) are characterized by Steponaitis (1980:122) as:

> A bowl which has an approximately hemispherical profile, without inflection or corner points. The lip diameter must be greater than three-fourths the maximum diameter; on simple bowls which lack a point of vertical tangency, the lip diameter is equivalent to the maximum diameter.

ple bowls can be slightly incurvate or excurvate at the rim and still be ssified as simple bowls. Vessels such as the simple "pinch pots" that are ll vessels formed from one lump of clay worked into a small simple vessel E. van der Leeuw, Appendix to this chapter) without the use of coiling will found under this heading.

When profile segments allowed the identification of a sherd as part of a l, but determination of its specific shape was not possible, the sherd was ted as a Miscellaneous Bowl.

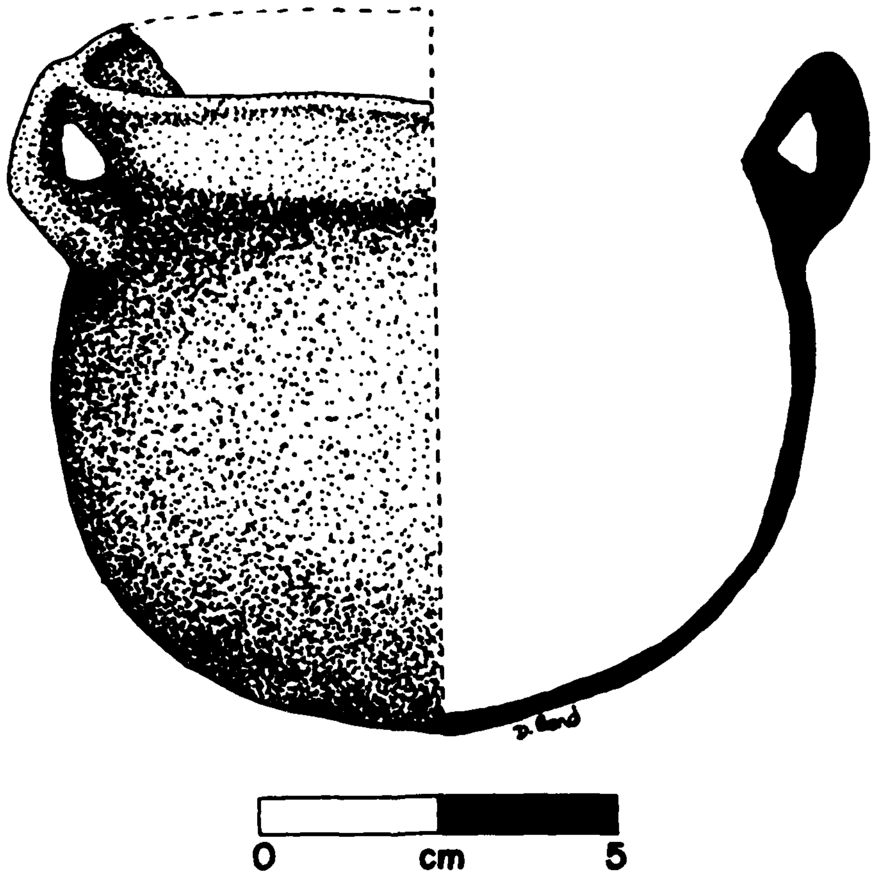


Figure 2. Mississippi Plain var. Warrior, standard jar form.

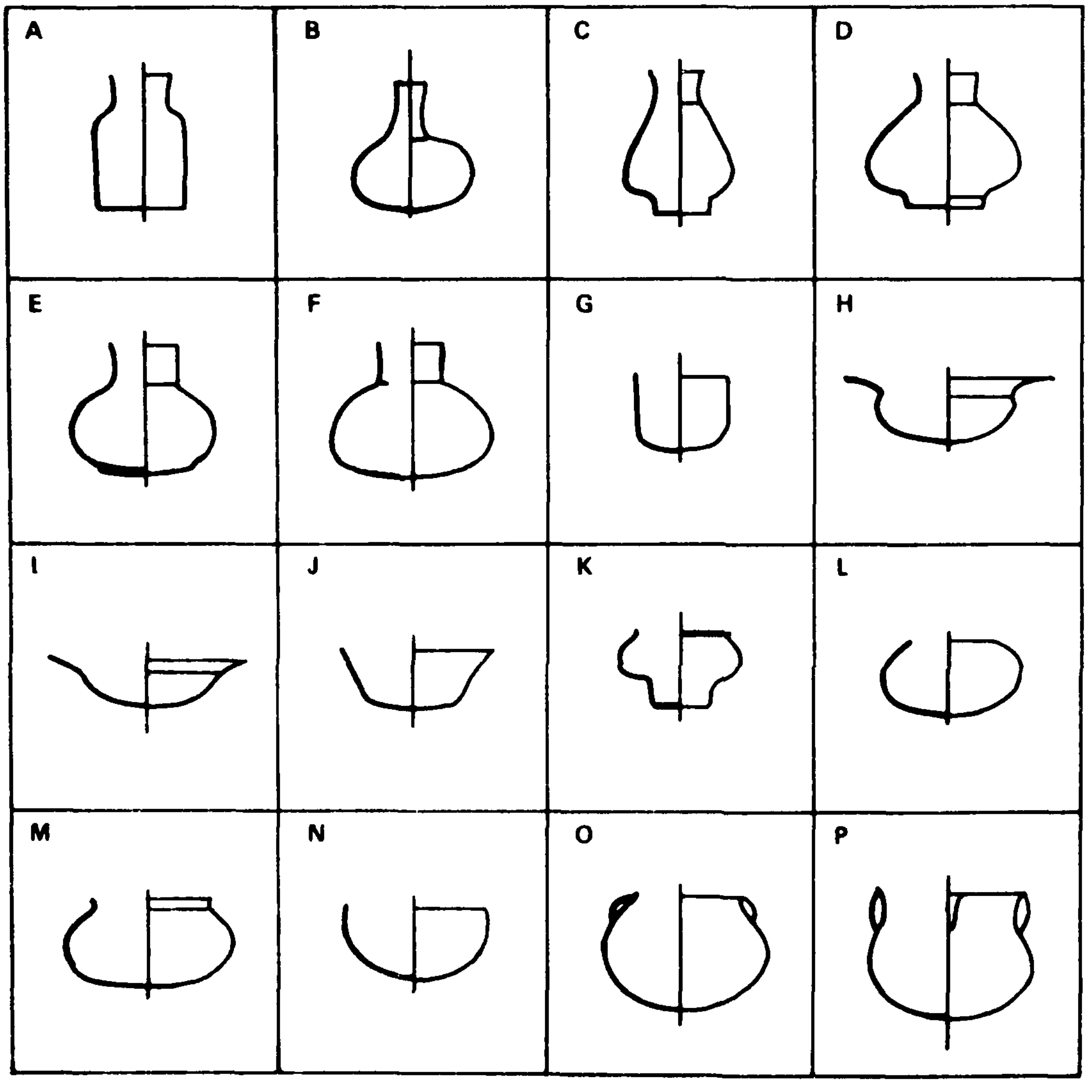


Figure 1. Basic shapes: A, cylindrical bottle; B, narrow neck bottle; C, slender ovoid bottle; D, subglobular bottle with pedestal base; E, subglobular bottle with slab base; F, subglobular bottle with simple base; G, cylindrical bowl; H, flaring rim bowl (deep profile); I, flaring rim bowl (shallow profile); J, outslanting bowl; K, pedestalled bowl; L, restricted bowl; M, short neck bowl; N, simple bowl; O, neckless jar; P, standard jar (from Steponaitis 1980:Figure 22).

examples of the basic shapes used by Steponaitis (1980) for the Warrior basin Mississippian ceramics, and his classification is used in this report. The only vessel shape not included in Figure 1 is the terraced rectangular vessel, an example of which can be seen in Figure 41.

Jars

This category, as described by Steponaitis (1980:122), is composed of

> ...vessels which have a more or less globular body, and a wide neck that is constricted in profile. The neck is typically less than one-third the height of the body, and the minimum diameter of the neck is no less than three quarters the maximum diameter of the body.

The jars in the collection studied from the Lubbub Creek Archaeological Locality usually had two handles, rounded bases, and a paste composition of coarse shell.

Standard jars (Figure 1P) are recognized by structural modification of the upper half of the vessel wall. From the vertical point of tangency on the vessel shoulder, the upper body constricts to a second point of inflection at the central area of the neck. From this point the neck curves outward away from the interior of the vessel to the end point referred to as the lip. Variation in neck to lip curvature may possibly be broken down for seriation within this vessel shape.

Neckless jars (Figure 10) are vessels in which the "neck never reaches a point of vertical tangency..." (Steponaitis 1980:123). In the ceramic collection from the Lubbub Creek Archaeological Locality, only one example of a neckless jar was recovered. The rarity of this shape is due to the fact that, when dealing with sherds, it would be combined with the restricted bowls unless the entire profile was present. This category is suited better to analysis where entire vessels are being observed.

Jar (Miscellaneous) is a category that was created to classify vessel fragments which could be identified as jar fragments, but whose exact jar form could not be determined.

Bowls

Within this class are vessels whose heights are not more than twice their own maximum diameter. These vessels range from large round flat "salt pan" bowls to restricted casuella vessels forms. The bowl category was divided into eight vessel forms (Figure 1G-N).

Cylindrical bowls (Figure 1G) are vessels whose height is equal to one and one-half times their own diameter or greater. To be included in this category the vessel walls must be vertically parallel from the right-angle formed where the vessel wall intersects the vessel base. The vessel wall should reach vertical tangency at this inflection with only slight, if any, variation in its vertical movement upward to the end point at the lip. Bases of this vessel form were both flat and rounded, and the rims were either modified to give a flat appearance or left in the rounded form.

During this segment of the analysis, examples of each ceramic type and variety and examples of all anomalies were pulled for further study. These sherds included those large enough to show vessel profiles, interior or exterior decoration or surface treatment, and [illegible] sherds which were incompatible with the established types and varieties. All other sherds were bagged by type and variety, then recombined with other material from the same provenience.

The sherds which were reserved for further analysis were used as a type collection. The collection was used to familiarize field crew members with the material encountered in the field and to have the material easily accessible for discussion with visiting ceramic experts.

After completion of the fieldwork, the type collection was examined to determine which attributes would provide further information when manipulated as independent variables. Three consultants were called in during this period: S. E. van der Leeuw of the Institute for Pre- and Protohistory, University of Amsterdam, Margaret Ann Hardin of the University of Maine at Orono, and Vincas Steponaitis of New York State University at Binghamton. Van der Leeuw aided the author by pointing out important technological traditions represented in the Lubbub Creek assemblage. Hardin viewed the ceramics with interest in distinguishing stylistic correlates of the types and varieties, and in recognizing individual styles and possible standardization of craft production. The last consultant, Steponaitis, viewed the ceramics in regard to the temporal framework he established for the Moundville phase. Vincas Steponaitis and the author then decided which attributes of the post-Woodland ceramics should be measured and devised procedures for the attribute analysis.

Attribute Analysis of the Mississippian and Protohistoric Ceramics

A series of attributes was formulated to study the Mississippian ceramics found at the Lubbub Creek Archaeological Locality. Because the Woodland ceramics from the site represented such a small percentage of the ceramics recovered, and because Jenkins (1979a) had recently completed an analysis of a much larger Woodland and pre-Woodland ceramic collection from the central Tombigbee River valley (which included material from the Lubbub Creek Archaeological Locality), this analysis has focused exclusively on the Mississippian ceramics.

After the field laboratory analysis was completed, all sherds were assigned to types and varieties if possible. Twenty-two major classes of attributes were then chosen which the author and consultants believed would give a better understanding of the Mississippian ceramic chronology and a refinement of the several types and varieties. These attributes will now be discussed in detail. The chronological seriation itself is presented in Chapter 3, Volume I; the basic counts and weights for all ceramics and the attributes for each measurable Mississippian sherd are presented in Volume III.

BASIC SHAPES

When possible, vessel shape was determined for each Mississippian sherd in the sample chosen for attribute analysis. Three broad categories -- jars, bowls, and bottles -- were subdivided into 15 basic shapes. Figure 1 shows

attributes. Sherds were assigned to types on the basis of their temper, surface treatment, and decoration. Within the types, varieties were established on the basis of patterned secondary attributes whose variation did not affect the type descriptions.

The classification of the pre-Mississippian ceramics from the Lubbub Creek Archaeological Locality are based on Jenkins' (1979a) classification of pre-Mississippian ceramics from the central Tombigbee drainage. However, there was not a comparable study of the Mississippian and Protohistoric ceramics from the central Tombigbee area. Therefore, the author has concentrated his research on the shell tempered Mississippian and Protohistoric assemblages from the Lubbub Creek Archaeological Locality.

The shell tempered ceramics of central Alabama are one segment of the ceramic puzzle which has been interpreted in numerous fashions in the last forty years. Dejarnette and Wimberly (1941) laid the foundation for the interpretation of the Mississippian ceramics, and their classification was reorganized subsequently by McKenzie (1964, 1965, 1966). However, as pointed out by Jenkins (1979a:54), the early typology "has proven a useful analytical framework by researchers but more recent analytical models are being adopted as archaeologists seek more precise means of documenting ceramic change and variability."

For example, the need for a chronological seriation of the Mississippian ceramic assemblages at Moundville had long been noted, and in the late 1970s such research was accomplished by Steponaitis (1980). In an effort to continue within the type-variety classification being used throughout the Southeast (e.g., Jenkins 1979a; Schnell 1979), Steponaitis used existing types when possible and, when appropriate, defined new varieties. The author organized the research on the Lubbub Creek ceramics to be compatible with the work of Steponaitis (1980), while hoping, through attribute analysis, to extend the utility of his classification.

RECOVERY AND LABORATORY PROCEDURES

The ceramics from the Lubbub Creek Archaeological Locality were recovered by hand, by waterscreening, by dry screening, and by flotation. Most were recovered in the waterscreen, from feature fill and levels and zones of excavation units. All material was checked into the field laboratory, and field records for each analytical unit were checked. If mistakes or discrepancies were encountered in the written record, the material was not processed further until corrections were made by the field supervisor. When all standards for processing by the field laboratory were met, the material from the quarter-inch waterscreen and dry screen was washed and sorted prior to analysis. Material from the one-sixteenth inch waterscreen was bagged and stored.

The ceramics were screened through a one-half inch mesh. Sherds which dropped through this screen were called "sherdlets" and were separated by temper type, counted, and weighed. Sherds which remained in the one-half inch screen were sorted into previously established types and varieties. Sherds were counted and weighed by type and variety. Each sherd was given a field specimen number which allowed recall of data for each sherd from the permanent records.

CHAPTER 1. CLASSIFICATION OF CERAMICS FROM THE LUBBUB CREEK ARCHAEOLOGICAL LOCALITY

Cyril B. Mann, Jr.

> To say that the choice of methods of classification is governed by the nature of the material to be classified is a truism. But it is no less governed by the predilection and general attitudes of the classifier, and particularly by the ends which the classifier has in view. The extent to which classification may be a creative activity is perhaps not sufficiently recognized (Phillips, Ford, and Griffin 1951:61).

To the extent that archaeology has become a many faceted science in recent years, ceramic data recovery and analysis has become more segmented and specialized in an effort to gain the maximum amount of knowledge from the material recovered. Because in fact ceramic classification is a dynamic, creative scholarly task, it has proven to be an extremely useful tool in archaeology. As early as 1930, Vaillant (1930:9) acknowledged "that the backbone of most of the New World chronologies is variation in pottery types..." This statement has proven true over the years, no more so than for the post-Archaic chronologies created for Alabama (Webb 1939; Griffin 1939; Haag 1939, 1942a, 1942b; DeJarnette and Wimberly 1941; Wimberly and Tourtelot 1941; Webb and DeJarnette 1942; Willey and Woodbury 1942; Willey 1948; Heimlich 1952; McKenzie 1964, 1965, 1966; Chase 1969; Cottier 1970; Sheldon 1974; Jenkins 1979a; Steponaitis 1980). The earlier of these authors laid the foundation for the later works. The present work once again represents a continuation of research based on these earlier works. Phillips, Ford, and Griffin's (1951) volume dealing with ceramic classification in the Mississippi valley, and Willey and Phillips' (1958) have proven invaluable during the course of this research.

The type-variety concept, which is used in the present study, is based mainly on the work of two authors: Phillips (1970) and Jenkins (1979a). Phillips (1970) first applied the type-variety concept to southeastern ceramics when dealing with the ceramics of the Yazoo Basin in the Mississippi valley. It is this typological system which Jenkins (1979a) adopted to achieve a compatible chronology for the central Tombigbee drainage. The type-variety concept has allowed types which are found both in the Tombigbee valley and the Mississippi valley to be compared and contrasted and has brought about a better understanding of the interaction of these diverse areas.

The three major objectives of the type-variety classification stressed by Phillips (1970:26-28) -- sortability, utility, and continuity -- are adhered to in this study. The type-variety classification is based on a hierarchy of

Figures

Chapter 1

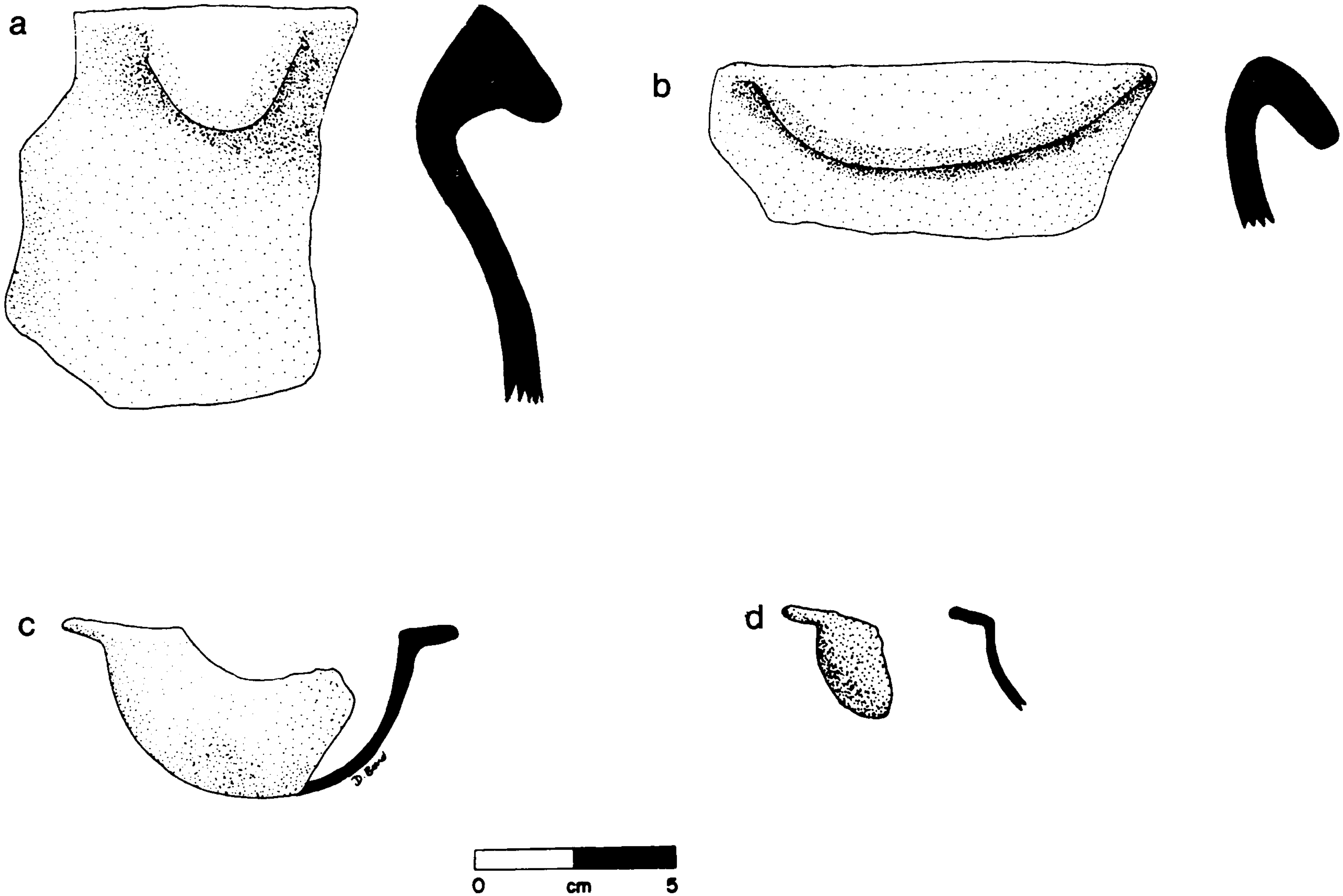


Figure 3. Mississippi Plain var. Warrior, a-b, downturned lugs; c-d, horizontal lugs.

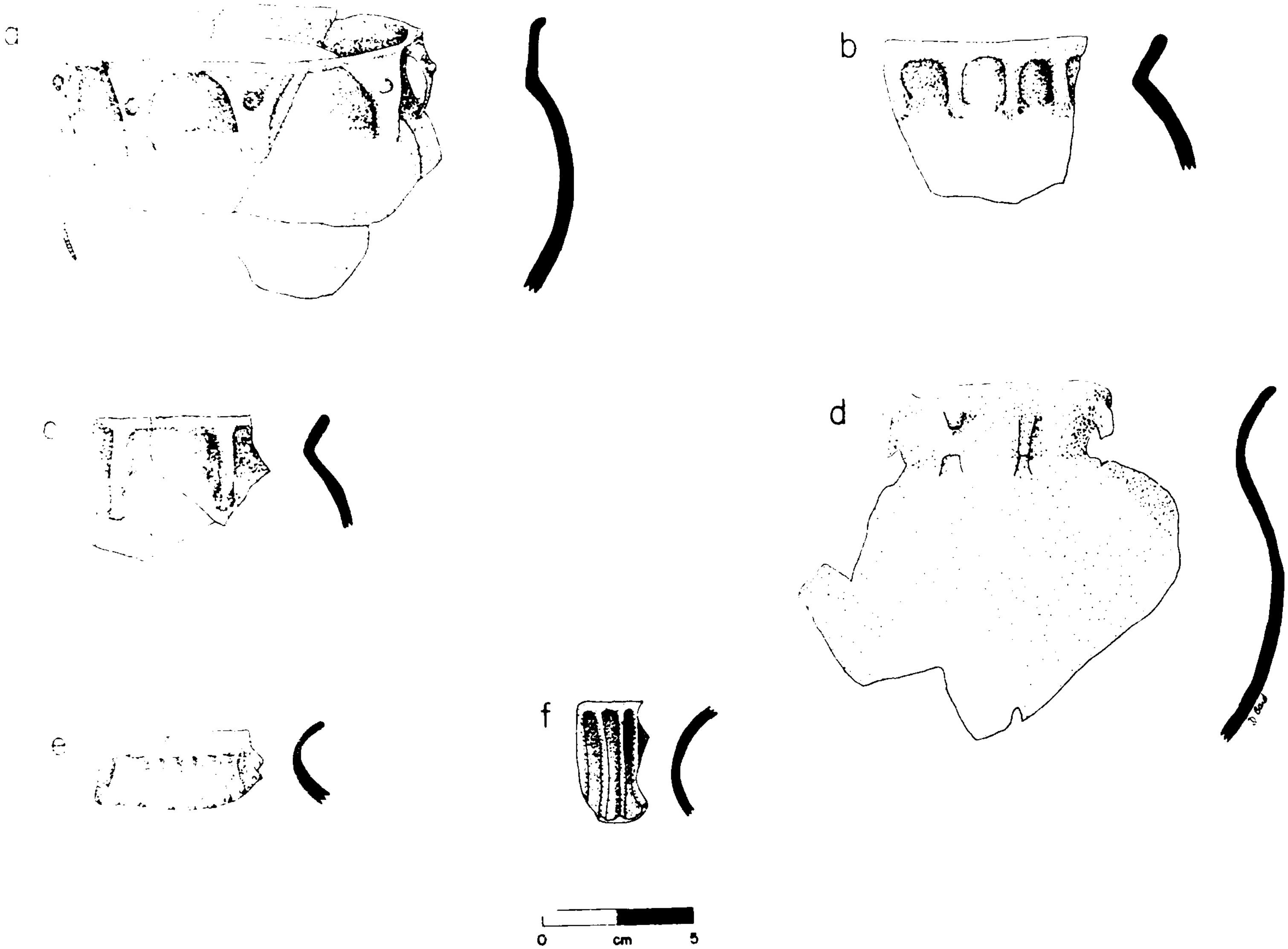


Figure 4. Alabama River Applique var. Alabama River, a, a standard jar with more than eight handles; b-d, standard jar forms with false handles; e-f, standard jar forms with applique neck fillets.

Beaded Rim

Beaded rims were found as a decorative element, usually around the rims of bottles and bowls. First, the area around the rim was thickened. This thickening was accomplished either by the application of a band of clay on the exterior surface at or just below the lip of the vessel or the lip itself was compacted. This area was then notched with a tool to create the beaded effect. Technological differences in beaded rims should be noted in future studies in which the data base is larger and observations can be made on a larger number of sherds.

Beaded Shoulder

All examples of beaded shoulders in the Lubbub Creek assemblage were formed by the application of clay strips which then were notched to produce a beaded appearance. The clay strip was probably added while the clay of the vessel wall was very plastic to ensure maximum bonding.

Horizontal Lug

A horizontal lug (Figure 3c-d) was a utilitarian addition to most vessel forms and was also used as a decorative element on effigy bowls. Horizontal lugs were incorporated into effigy forms as the tails of waterfowl, beavers, and fish. The lugs were attached directly to the rim of the vessel. The handles and the vessel wall were more often joined by riveting than by luting.

Scalloped Rim

Scalloped rims usually were found on outslanting and flaring rim bowls. In the Lubbub Creek collection, the "scallops" were rounded (Figure 5a-f).

Deep Profile (Flaring Rim Bowl)

This attribute was established to differentiate between flaring rim bowls whose profiles did and did not reach vertical tangency before flaring. If the vessel profile reached vertical tangency before the point of inflection, it was designated as a "deep profile" flaring rim bowl (Figure 1H). If vertical tangency was not achieved, it was termed a "shallow profile" flaring rim bowl (Figure 1I).

Pedestal Base

Pedestal bases are found only on the base area of certain bowls and bottles (Figure 2B). Pedestal bases are usually hollow and are formed by pressing clay into a cup or small bowl. Their interior surfaces sometimes have latent impressions which reflect this procedure. When the pedestal had been constructed to the desired height, the remainder of the vessel body was built atop the pedestal.

Slab Base

A slab base consists of a thickened slab of clay upon which the remainder of the vessel was built (Figure 1E). The point at which the slab ends and the coiling for the wall begins is evident on the exterior of the vessel by the

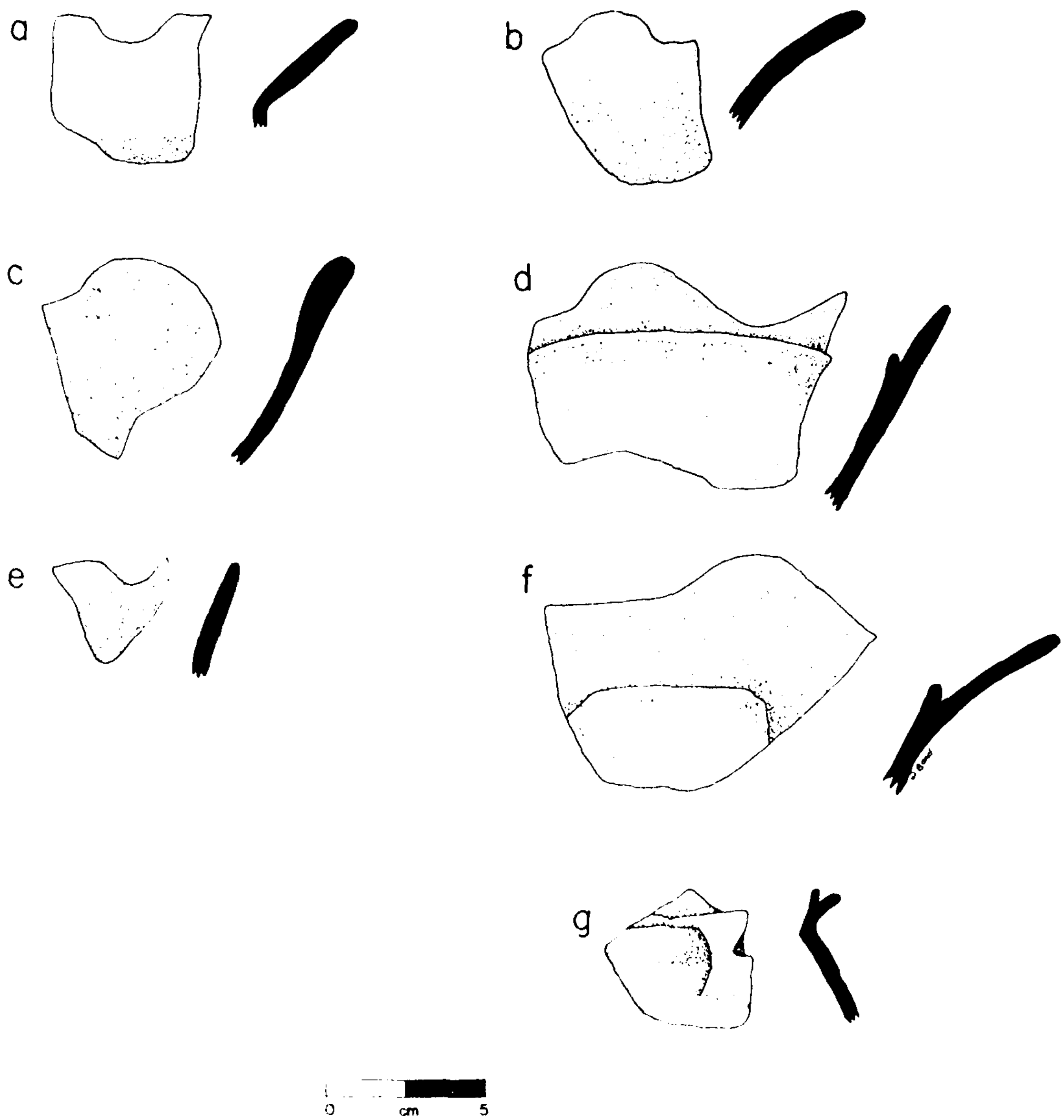


Figure 5. Mississippi Plain: a,b,d,f,g, _var._ _Hale_, scalloped rims; c,e, _var._ _Warrior_, scalloped rims.

abrupt decrease in thickness from the base to the lower body wall. The slab base is solid, unlike the pedestal base which is hollow.

Indentations

Indentations are defined as concave surface deformations produced by the displacement of clay by pressure to the outer surface of a vessel while the vessel paste is still plastic. This practice was used to decorate some bottles and rectangular vessels.

Narrow Mouth

A vessel was recorded as having a narrow mouth if its orifice diameter measured less than one-third the diameter of the vessel at its widest point.

Nodes

This category includes any nodes not found on handles. Nodes in this instance refer to small round applique nodules of clay which were applied to the exteriors of bowls, bottles, and jars (Figure 27 and 45).

Notched Lip

A notched lip results when an incision is made across the top of the vessel lip, from the interior surface to the exterior of the vessel (Figure 12).

EFFIGY FEATURES

As noted by Steponaitis (1980), effigies may be considered secondary features, although the shapes of some effigy vessels are significantly altered to suggest the likeness of the creature depicted (Figure 6). These effigy vessels differ from simple bowls with rim effigies which are placed on the vessel rim (Figure 7), causing little or no structural change of the vessel.

Frog Bowl

This effigy form has distinguishable attributes even at the sherd level of analysis. The frog head was formed or applied on one side of the vessel just below or even with the rim. Angular legs were applied to the sides of the vessel as one moves away from the head toward the opposite side of the vessel. A node or indentation appears on the side of the bowl opposite the head.

Fish Bowl

This effigy bowl is not as distinguishable as the frog bowl, because the features used on this bowl are also found on other effigy bowls or as single occurrences. The head (Figure 7a) and the tail (Figure 7b) are the two diagnostic parts of this vessel. They were modelled, then applied to the vessel wall on opposite sides of the vessel. The dorsal fin was usually represented by a beaded rim or shoulder on one side of the vessel, and the ventral fins are either nodes or beaded strips on the rim or shoulder opposite the dorsal fin. When viewed from above, the entire fish is observed.

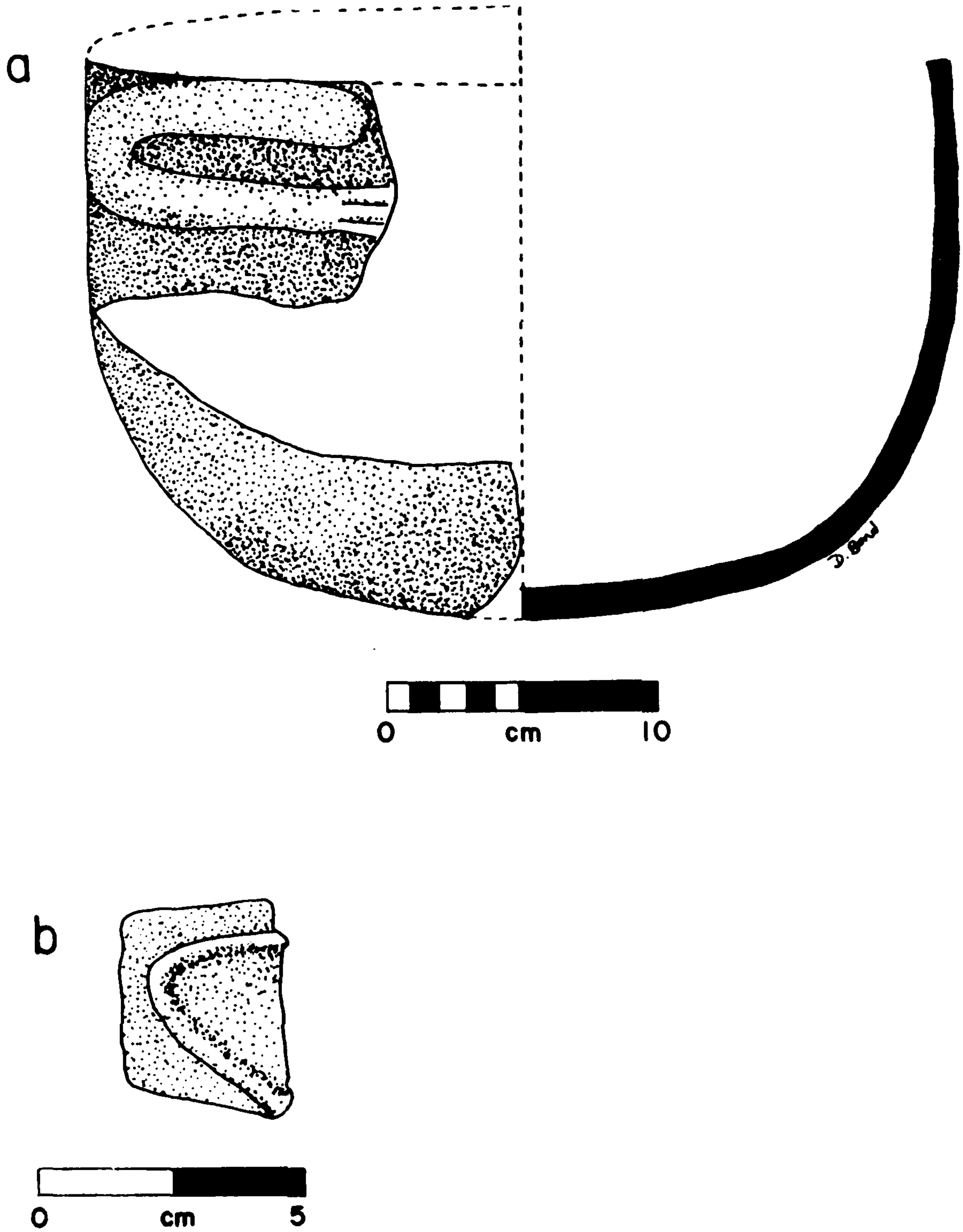


Figure 6. Mississippi Plain *var. Hale*, a-b. effigy bowl fragments.

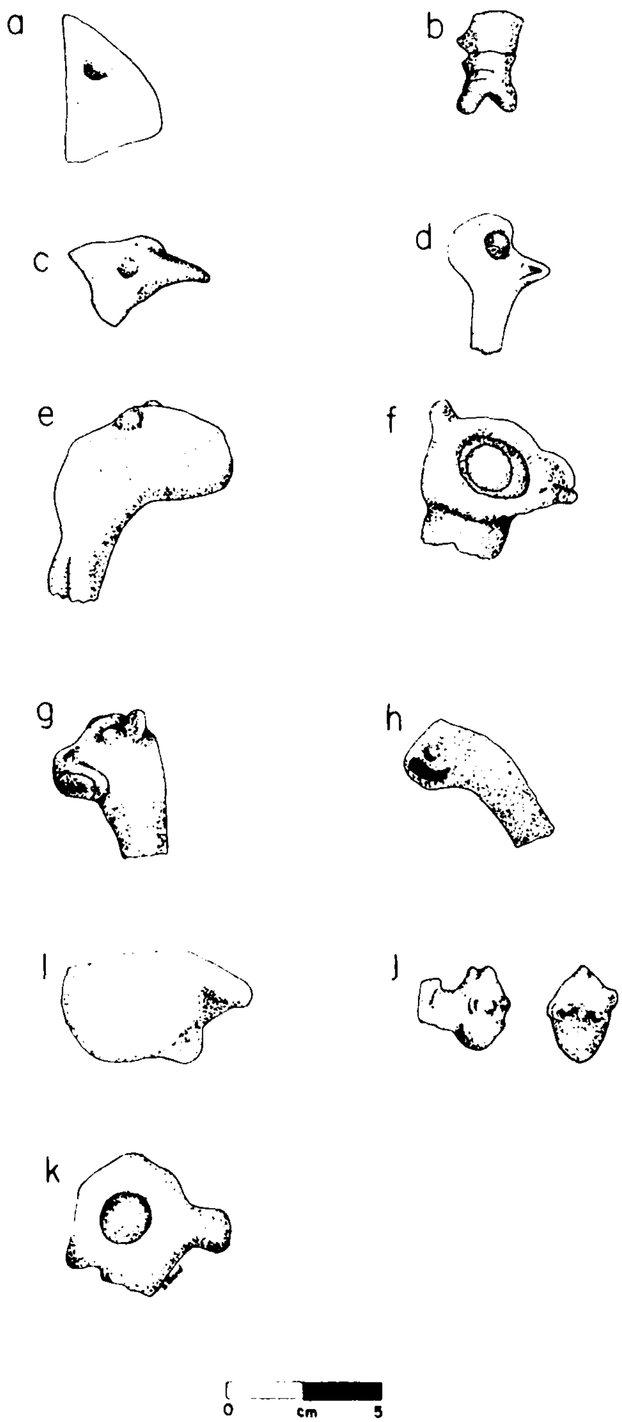


Figure 7. Mississippi Plain var. Warrior and var. Hale, effigies: a, var. Hale, fish bowl effigy fragment (fish head); b, var. Warrior, fish bowl effigy fragment (fish tail); c, var. Hale. Bird effigy II; d, var. Warrior. Bird effigy I; e, var. Hale, other effigy (probably avian); f, var. Hale, other effigy (squirrel/owl effigy); g. var. Warrior, other effigy (bear/bat effigy); h, var. Warrior, other effigy (snake/turtle effigy); i, var. Warrior, other effigy; j, var. Hale, human head medallion; k, var. Warrior, Bird effigy I.

Bird I

When the preliminary analysis was completed, a number of different avian effigies were recognized. A flat "cookie cutter" form (Figure 7d) was noted. This form was different than the "cookie cutter" forms described by Steponaitis (1980:135) for Moundville. The form found in the Lubbub Creek collection had a distinct neck, a small node for an eye, and a pointed bill. The direction this effigy was facing on the vessel could not be determined.

Bird II

This effigy form encompasses all avian effigies which were modelled and formed rather than cut out of a flat piece of clay. At no point during the excavations were any vessels found with avian effigy forms attached to the vessel wall. Thus orientation of these effigies cannot be determined.

Human Head Medallion

This modeled effigy depicted the human head (Figure 7j). The head was oval with features such as mouth, nose, ears, eyes, fore-lock, and top-knot portrayed by small nodes of clay. The neck of the head medallion was riveted directly to the exterior vessel wall just below the lip of the vessel instead of being supported by a thickened wall, as were other effigy forms.

Other Effigy

An "other" category was established to note all occurrences of effigy forms which did not conform to the divisions noted above. Within this category one finds the mass of effigies which exhibited characteristics which allowed recognition to the mammal, reptile, or amphibian level. This group was represented by a bear/bat effigy (Figure 7g), a snake/turtle effigy (Figure 7h), a squirrel/owl effigy (Figure 7f), and a small modeled effigy of a mammal which could be a canine form.

Supports

To gain a better understanding of the vessel forms on which effigies occur, all instances of wall thickening were noted under this section dealing with effigies.

DELIBERATE SURFACE COLORING

Surface treatment for the purpose of vessel coloration was noted. This observation was made in the hope of describing differences in coloration among post-Woodland ceramics. Other than one burial urn cover which was painted on the interior, however, most of the data came from vessel fragments and sherds too small to determine vessel forms. Because of this fact, the distribution of painted wares on the site was plotted to see if there was a co-occurrence of specific painted wares with certain middens. The occupation pattern on the bend complicated this approach. The painted wares were found to occur across the site on the areas with the highest elevations. These locations were also the most densely occupied areas of the site. Heavy occupation of these areas caused a great deal of mixing of archaeological materials, so that the chronological position of the painted wares could not be determined.

Smudging (Black Filming)

Although the ceramics which have been called black filmed were not painted, the shiny black surface color still represents a deliberate technological modification. A number of different methods may have been used to achieve this surface condition, but the techniques used could not be recognized from the end products. Steponaitis (1980) suggested that black filming on ceramics at Moundville may have been produced by smudging techniques as described by Shepard (1956:88) as a "means of blackening pottery by causing carbon and tarry products of combustion to be deposited on it." Steponaitis (1980:45) stated that "As long as the reduction and smudging were of relatively short duration, their effects would be confined to the surface." Reduction in combination with smudging is thus proposed by Steponaitis as the possible method of attaining the black filmed appearance.

An analogous method of applying a lustrous black surface to ceramics made from local clay sources was demonstrated by Ned Jenkins and Robert Lafferty (personal communication). The preparatory treatment of the vessel to be fired was a major factor of this technique of "black filming." When the vessel had dried and was ready for firing, the surface of the vessel was dampened and smoothed with a small smooth rock. The action floated the small clay particles and aligned them on the surface. After the entire vessel was prepared in this manner, the vessel was fired in a reducing atmosphere. The end result was a surface which appeared to be black filmed. The preparation of the vessel surface in a pre-fired state was shown to produce the desired effect when combined with a reducing atmosphere during firing. A non-reducing atmosphere was found to produce a white surface when the same local clay was fired.

One other method of black filming has been described to the author but not observed. In this method (Gerald Smith, personal communication), surface color modification takes place after the vessel has been fired. The vessel is taken immediately from the fire and placed in boiling grease. The results depend on vessel temperature and the combustion of greases when the vessel is removed from the boiling pot. The end coloration reportedly can vary from glossy black to mottled reddish brown.

The author could perceive no method to distinguish techniques of smudging or black filming in the Lubbub Creek collection.

Red Painted

The most common painted wares at the Lubbub Creek Archaeological Locality were red painted. This paint was a prepared slip of hematite and clay applied to the vessel surface. When fired in a non-reducing atmosphere, the iron-rich slip became bright red.

White Painted

To achieve a white slip on the ceramics, materials were not added to the clay to be used as a slip, but rather an iron-free clay slip was applied to the surface of the vessel, allowed to dry, then burnished. The vessel was then fired under oxidizing conditions, bringing out a lustrous white finish.

d and White Painted

Red and white painted ware was uncommon at the Lubbub Creek chaeological Locality. Steponaitis (1980:47) described the process used to hieve this painted ware as follows:

> The red and white effect usually was achieved by first slipping the vessel with a white-firing (iron-deficient) clay, and then covering certain areas of the slip with red-firing (iron-rich) clay.

en the red and white painted wares from this collection were examined, this ocess appeared to have been used. After the slips were applied, the vessels re fired in an oxidizing atmosphere. The iron-rich (red) slip became idized, but the iron-deficient (white) slip was not affected and retained s natural color.

ssing

When a sherd was identified to type and variety but deliberate surface loring was too weathered or eroded to determine the original state, the liberate surface coloration category was left blank to note this condition.

ACEMENT OF COLORING

To ensure a clear understanding of color placement on the vessel, the tegories interior, exterior, and both interior and exterior were noted when ey could be determined. When a sherd was too small to be placed in these tegories, this section was left blank.

JRFACE FINISH: EXTERIOR AND INTERIOR

Each sherd was examined for exterior and interior surface finish. Each rface had three possible finishes: burnished, unburnished and smoothed, and burnished and scraped.

rnished

A burnished surface, also called polished by Shepard (1956:66), was eated when the surface of the vessel was dampened and rubbed with a smooth ock or fine piece of leather. The surface must be smooth before burnishing kes place to avoid having unburnished areas on the surface of the vessel. e end result of burnishing the surface is the alignment of the plates of ne clay on the burnished area to achieve a lustrous finish. When a vessel referred to as having been highly polished, the vessel has a reflective uality achieved by continued burnishing for an extended period of time. rnishing could be viewed as a preliminary step to polishing, as the eparation of the vessel surface without producing the reflective qualities a high polish. Burnishing could also be viewed as a non-high gloss polish. ter examining the collection under study, the author deemed the difference tween burnished and polished insignificant for this study, and all sherds ich exhibited surface treatment as described above were placed in the rnished category.

Unburnished and Smoothed

This category includes sherds whose surfaces had been smoothed but not burnished. The surface which was smoothed was the natural clay of the body wall, to which no slip had been added. This process was used to help join the coils by surface compaction, to remove coiling marks created by the building of the vessel wall, and to help ensure an even wall thickness to reduce the probability of firing loss due to uneven heating and cooling.

Unburnished and Scraped

Sherds which exhibited wall thinning by removal of clay by scraping were put into this category. Because scraping occurred after the vessel was formed, but before any other surface treatment, evidence for scraping was usually obscured by smoothing and burnishing. Attention was focused on which vessel forms this technological modification occurred, at which point in the developmental sequence of ceramics the modification occurred, and at what point in time it ceased to be exhibited in the assemblage.

TEMPERING MATERIAL

Shell Temper

The single most important criterion for recognition of the Mississippian period in the central Tombigbee drainage was the introduction of shell tempered ceramics. The shell tempering varied in size from microscopic to over four millimeters. Temper size usually varied within a single sherd, but a temper size apparently was selected for by the potter, because most of the shell within a single sherd is fairly consistent in size. Greater variation was found in the groups with larger average temper size than in those with smaller average temper size. In this study, if the size of the third largest temper particle fell below two millimeters, the paste was considered fine. Plain shell tempered ceramics were classified into varieties on the basis of temper size.

Grog Temper

In the collection of ceramics from the Lubbub Creek Archaeological Locality, no Mississippian wares were found to exhibit grog tempering as a sole tempering agent. When grog tempering was noted, it was always in combination with shell temper in the paste.

Shell and Grog Temper

The only other temper type noted for the Mississippian ceramics from the Lubbub Creek Archaeological Locality was mixed shell and grog. Study of this specific attribute is important because mixed shell and grog tempering was possibly a result of intra-regional interaction during the Mississippian period rather than a development from the earlier, Late Woodland, ceramic assemblage. The author observed that mixed grog and shell tempering almost always occurred in the fine tempered, usually highly burnished wares, composed of vessel shapes which are only found in the Mississippian ceramic assemblage in this area. In the entire collection, less than one percent of the mixed shell and grog tempered wares had grog temper particles larger than two

'imeters. Even when noted, the larger grog inclusions did not occur ;istently throughout the paste. It is possible that they were natural lusions combined within the paste because of their common occurrence in a amic workshop area.

ł Temper

During the Mississippian period at the Lubbub Creek Archaeological ality, sand was not the sole tempering agent of any ceramic wares.

?ER SIZE

Temper size, as well as wall thickness and shape of the vessel, is a tor which may increase or decrease the probability of the vessel remaining act through the firing process. As vessel shape was determined by the ter, so too were the elements which constituted the ceramic paste. Certain per sizes were sought and selected, and they may have been chosen with cific functions decided for the vessels. Steponaitis (1980) has onstrated the effect of thermal shock on different paste compositions. ording to the results of his experiments, the coarse shell tempered wares a lower breaking threshold at first firing than did the fine shell pered wares. After first firing, the cracking threshold dropped by nearly f for the fine tempered wares, but the coarse tempered wares retained ly their original breaking threshold. In continued firing the coarse ll tempered wares retained their ability to withstand repeated thermal ck, but the ability of the finer tempered wares to withstand thermal shock reduced so radically that continued exposure to fire was likely to cause vessel to crack (Steponaitis 1980:66-83). Because of the limited amount data presented by Steponaitis, firm conclusions must await further erimentation.

For this study, the third largest temper particle was measured. In the ssification of shell tempered sherds, if the temper size fell below two limeters, the ware was considered fine. If the temper size was larger than millimeters, the ware was considered coarse. To test the validity of this itrary distinction, the temper size of all shell tempered sherds was tted on a histogram. The result was a bidmodal distribution. One peak ompassed sherds which contained shell particles between 0.7 and 1.3 mm in e, the other peak encompassed sherds with shell particles between 2.1 and mm in size. For information on temper size of individual types and ieties, the reader should refer to descriptions of these in the next tion.

FILE SEGMENT

Most of the material recovered from the Lubbub Creek Archaeological ality was sherds rather than whole vessels. In an effort to ensure as plete a description of the material as possible, the author tried to ermine which section of the vessel profile each sherd represented. When s determination was not possible, the category was left blank, and the file segment was deemed indeterminate.

The vessel form was first divided into six possible profile segments. er long deliberation, these were reduced to three possible segments. They

are: the neck, the shoulder (Figure 8), and the lower body, which is the segment between the shoulder and the base. It was decided that the three profile segments named would allow as maximum a differentiation in the analysis as possible.

END POINT

The distinction was made whether or not the end points were present on the profile segment being studied. An end point was present on a sherd if either the rim or base section of a vessel was represented (Figure 8). When a complete profile was present, the category "complete" was checked.

LINE TYPE

The most common decoration elements on Mississippian ceramics were incised or engraved motifs. These elements have a large range of variation because of the large number of variables which affected the end product. These variables include the paste composition, the degree of dryness of the vessel wall, the type of tool used, and the amount of pressure exerted by the potter. The author attempted to describe how wet or dry the vessel surface was at the time the decoration was applied. The three categories used were: wet paste, leather hard paste, and bone dry or fired paste.

Wet Paste

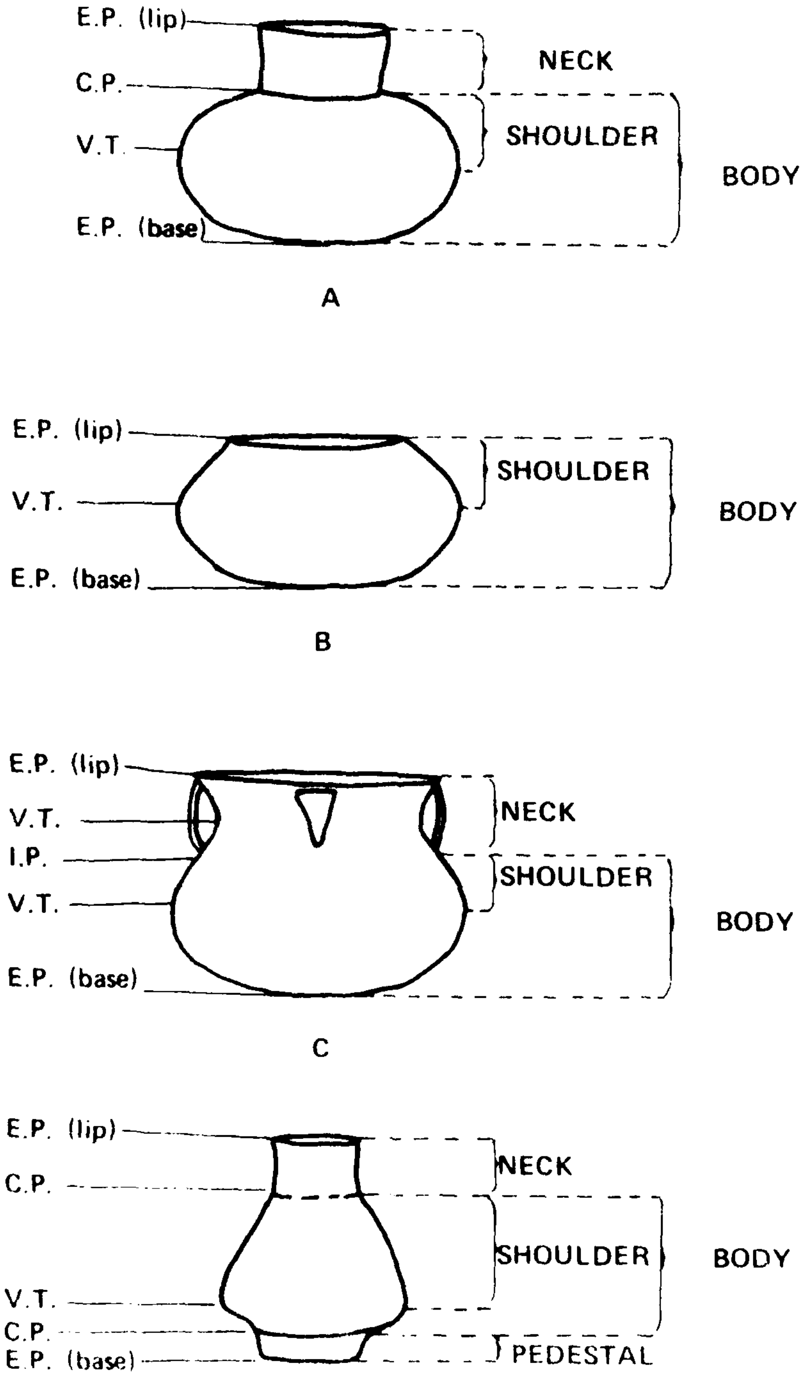
An incision on a wet paste causes displacement of clay along the path of the incision. The displacement affects not only the clay directly along the line of incision, but also along the areas adjacent to the cut on either side. The displaced clay is forced out of the trough of the incision and compressed onto the areas of the vessel wall adjacent to the incision, causing a slight increase in sherd thickness on each side of the wet paste incision. Often the displaced clay appears to have been smeared along the edge of the cut.

Leather Hard Paste

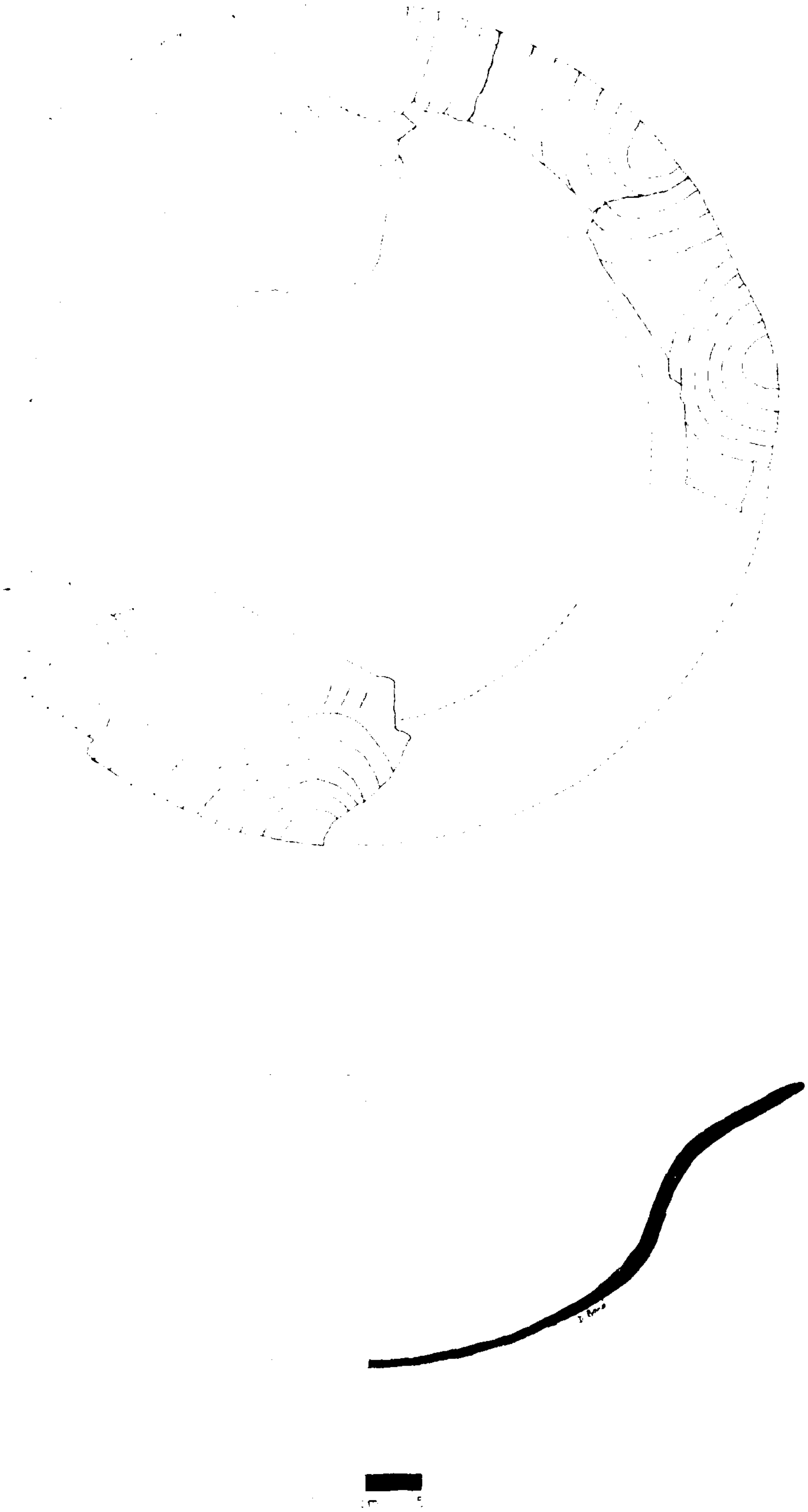
When the paste of the vessel had dried so that movement of a tool usually compacted the clay at the bottom of the cut and the excess clay from the trough was removed from the body of the vessel, the paste was described as leather hard. This type incision is often called broadline trailed incised (Steponaitis 1980; Jenkins 1979a). The broadline trailed incisions (Figure 16) are wide, and there is often evidence of tool cut in the bottom of the incised trough.

Bone Dry or Fired Paste

Because of the difficulty in differentiating between vessels which were sun-dried, burnished, engraved, and then fired, and those which were sun-dried, burnished, fired, and then engraved, the author deemed it appropriate to study the two groups together rather than try to find some elusive point of differentiation. The material in this class was usually very dry and hard so that any movement of a tool through the paste actually removed the material from the trough of the engraved line, leaving a smooth hard trough. When a bone dry or fired paste was incised, the edges of the incisions crumbled and broke.



[illegible] components of different vessel forms: A, [illegible]; B, bowl; [illegible] bottle with pedestal base [illegible] Stephan[illegible]



5. Alabama River Incised var. Alabama River, burial urn cover.

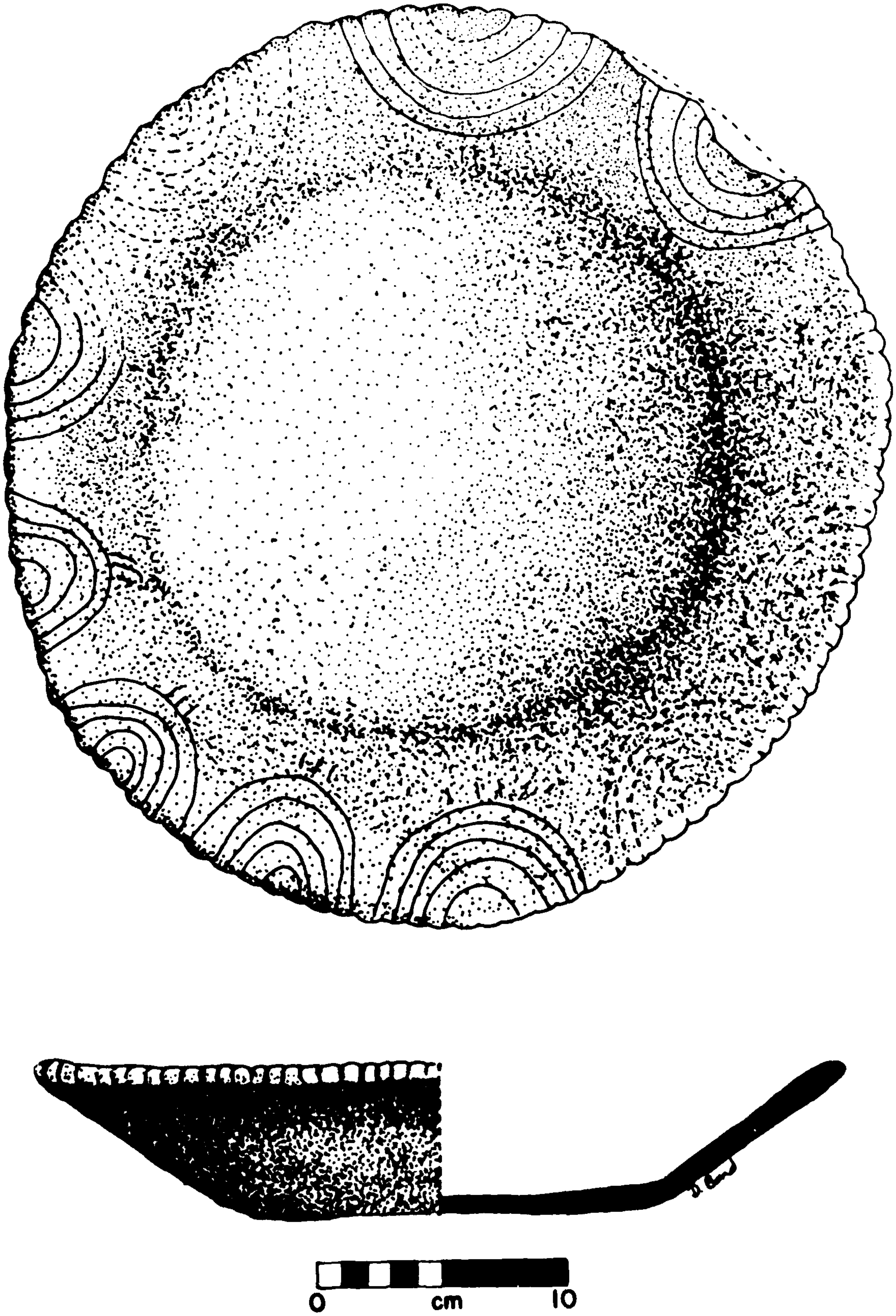


Figure 12. Alabama River Incised var. Alabama River, burial urn cover.

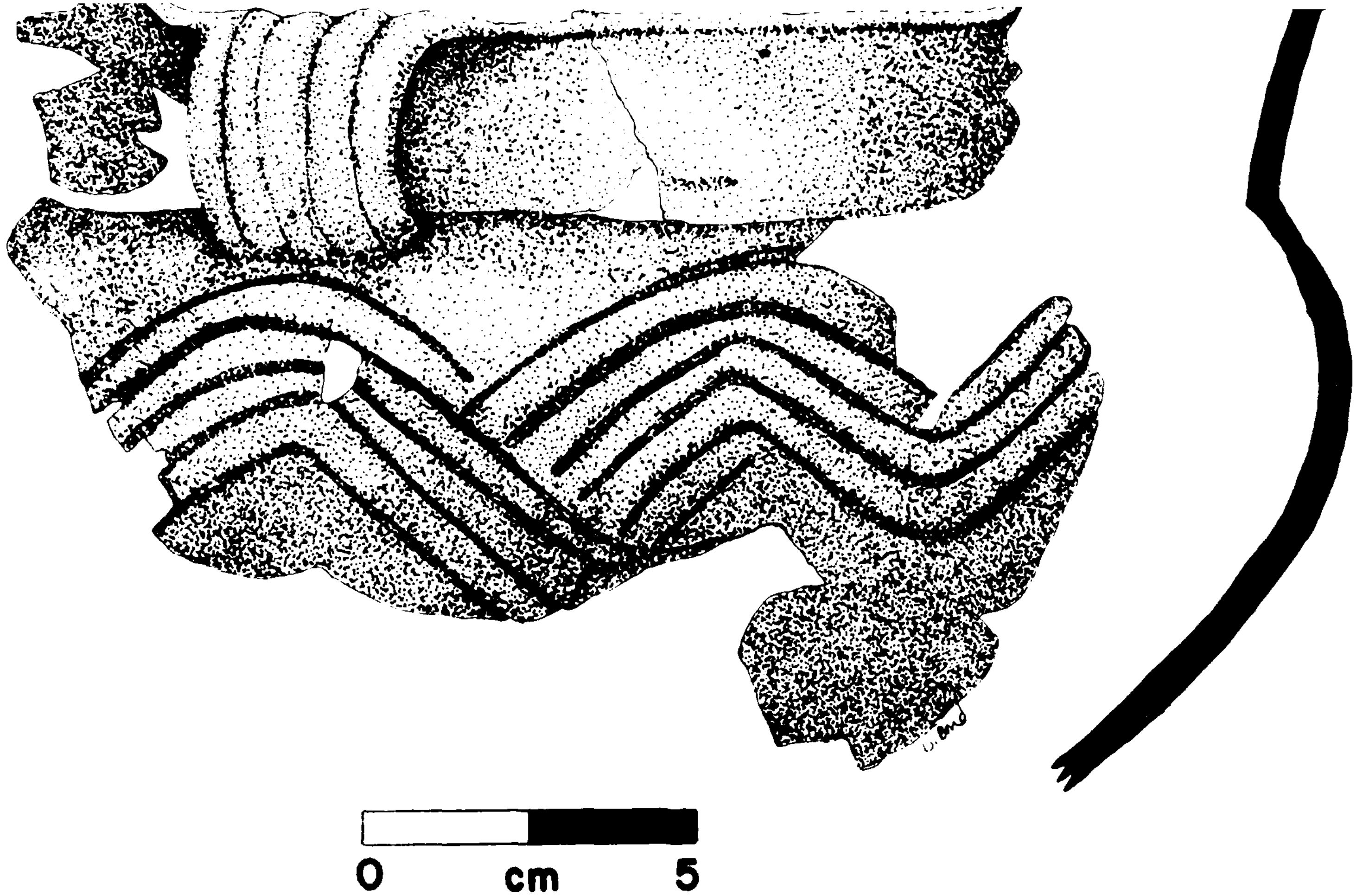


Figure 11. Alabama River Incised var. Unspecified (possibly historic Chakchiuma).

The most common applique fillet decoration at the Lubbub Creek Archaeological Locality was vertical neck fillets (Figure 4e-f) applied to the neck area of standard jars and short neck bowls. Also found on the site were applique designs formed by the placement of diagonal fillet strips from the neck area of the vessel to the upper area of the vessel's shoulder. These decorations were always found on vessels with excurvate rims, with a range in temper size from 0.9 mm to 3.2 mm. The mean temper size was 1.85 mm (n=65; s=0.50). One sherd contained mixed shell and grog, but the remainder were shell tempered.

ALABAMA RIVER INCISED

Documentation: Cottier 1970; Sheldon 1974.

General Description

The type name Alabama River Incised has tentatively been used to describe three burial urn covers, three carinated vessel fragments with incisions between the point of inflection on the vessels' shoulders and their rims, and three sherds which were similar to wares from Mississippi described by Atkinson (1979:62-63) as possibly historic Chakchiuma. These latter sherds had a mixed sand and shell tempered paste and had curvilinear incisions on their exterior surfaces. One sherd was a short neck bowl fragment (Figure 11) which had curvilinear incisions on its shoulder. The most distinctive likeness between this vessel fragment and those described by Atkinson (1979) was the attached broad strap handle with vertical incisions on the exterior surface.

Two different styles of incised designs were noted on the interior surfaces of the flaring rim bowls used for burial urn covers. Two of the three incised burial urn covers were incised with a repeated design of four to eight concentric arches on the interior rim of the vessels (Figure 12, 13). The only addition to this design was the incision of three small lines or rays below the arches. On the vessel shown in Figure 12, the rays were incised below each design, but on the vessel shown in Figure 13, the rays were incised only below selected arches. One of these burial urn covers (Figure 12) had a notched rim. The second incised design on the interior of a burial urn cover was a stylized hand motif as shown in Figure 14. This design was composed of hands comprised of four to five fingers and thumbs, with a triangle which represented either the palm of the hand or the wrist. Short lines or dashes were incised on the base of the triangle and along the lengths of the fingers. The three burial urn covers were all flaring rim bowls. The designs incised on the upper bodies of the three carinated vessel fragments are shown in Figure 15a-b.

The incisions on these late Alabama River phase vessels showed a great deal of variation in line width, from 1.6 mm to 3.7 mm. The mean line width was 2.63 mm (n=6; s=0.75 mm). One sherd was incised on a wet paste, and the other five were incised on a leather hard paste. Temper size ranged from 0.5 mm to 3.1 mm. The mean temper size was 1.58 mm (n=6; s=0.92 mm).

Two of the six examples were smudged or blackfilmed on the interior, although the effect was not as lustrous as noted for the earlier Mississippian wares. The exterior surfaces of three had been burnished, and three were

TABLE 2

Sample Statistics for Alabama River Applique _var._ _Alabama_ _River_ Handles.

	N	Minimum (mm)	Maximum (mm)	Mean (mm)	Standard Deviation (mm)
Top Width	38	5.9	40.0	10.6	6.5
Middle Width	46	3.9	18.2	7.0	2.4
Bottom Width	24	3.7	13.6	6.7	2.5
Middle Thickness	49	3.9	8.7	5.7	1.1
Clearance	7	0.8	7.9	4.2	2.4
Height	19	9.5	35.8	23.2	6.0
Distance Below Lip	10	1.8	12.4	7.4	4.2

application from functional to applique was noted for the Middle Mississippi valley, where Chapman and Anderson (1955:42-44) described vessels with applique handles as Campbell Applique. Jenkins (1979a) chose to deal with this material on the type-variety level, but left open the possibility that it could be simply a rim mode as categorized by Phillips (1970:61).

After close observation of the Alabama River Applique sherds from the Lubbub Creek Archaeological Locality, the author agrees with the type-variety level of classification for this material.

Multiple handles play an important role within this type. By terminal Summerville III, handles increased to as many as 10 or more on a single vessel. The Alabama River Applique is probably Late Mississippian. The earliest dated Alabama River material is from a structure at the Lubbub Creek Archaeological Locality which was excavated by Jenkins during his 1977-78 field season. The structure was radiocarbon dated A.D. 1410 ± 45. Jenkins (1979a) assigned this structure to the Moundville III subphase.

The Alabama River assemblage appears to have reached its major degree of complexity sometime between 1500 and 1650 A.D. Radiocarbon dates have been obtained by Curren (Curren and Little 1981) which date an undisturbed Alabama River component in the Black Warrior drainage at A.D. 1545 ± 60.

Probable Relationships

The most closely related ceramics are probably Mississippi Plain var. Warrior, from which this type probably developed (Jenkins 1979a; Steponaitis 1980). It is also similar to Campbell Applique of the central Mississippi valley (Chapman and Anderson 1955) and to the Alabama River phase material described by Sheldon (1974) for the Alabama River area of south Alabama.

Alabama River Applique var. Alabama River (Figure 4)

Sorting Criteria and Attributes

Only one variety, var. Alabama River, has been established for the Alabama River Applique material found at the Lubbub Creek Archaeological Locality. Material was classified as var. Alabama River if it had applique handles or applique neck and shoulder decorations. All Alabama River Applique vessels were globular jars which appeared to have been manufactured by coiling and which had smoothed, but not burnished, surfaces. No instances of deliberate surface coloration were observed on vessels of this type.

Often the clearance of the individual handles varied on a single vessel. Some handles had a clearance of 1-2 mm, while other handles made contact with the vessel wall for their entire length. Handles varied from simple coils which were round in cross-section and applied to the neck area of standard jars (Figure 4b-d) and simple bowls, to triangular shaped handles found on burial urns and some standard jars (Figure 4a). On what appeared to be early Alabama River Applique vessels, occasionally the handles were decorated with a single node in the upper middle area of the handle. The sample statistics for these handles are presented in Table 2.

TABLE 1

(Continued)

[illegible]	Total Count and Weight Phase I, II, and III			Diagnostic Sherd Count Phase I, II, and III
	Rim	Body	Weight (gms)	Count
Other				
[illegible]	-	408	2,562	7
[illegible] Engraved	-	-	-	1
Exter[illegible] Incised	-	-	-	14
[illegible] Engraved	-	-	-	1
[illegible] Incised	-	-	-	41
[illegible] Red	-	-	-	1
[illegible]	-	-	-	1
N[illegible]ed	-	-	-	3
[illegible]	-	-	-	34
Red and white	-	-	-	2
[illegible]	-	-	-	7
[illegible]	-	-	-	2
Small Sherds		132,407	53,351	

TABLE 1

Summary Measures of Shell Tempered Ceramics.

Type/Variety	Total Count and Weight Phase I, II, and III			Diagnostic Sherd Count Phase I, II, and III
	Rim	Body	Weight (gms)	Count
Alabama River Applique				
Alabama River	45	26	1,543	65
Alabama River Incised				
Undetermined	-	-	-	6
Barton Incised				
Undetermined	2	10	21	-
Demopolis	4	2	6	-
Bell Plain				
Big Sandy	13	166	889	71
Carthage Incised				
Undetermined	12	110	589	5
Carthage	8	25	399	14
Foster	2	6	48	8
Moon Lake	27	29	1,425	55
Summerville	-	1	23	1
Chickachae Combed				
Undetermined	4	-	12	4
Kimswick Fabric Impressed				
Undetermined	-	2	25	2
Mississippi Plain				
Undetermined	24	74	2,942	-
Warrior	2,782	52,233	241,649	607
Hull Lake	3	28	348	17
Hale	427	2,921	14,878	238
Mound Place Incised				
Undetermined	4	169	31	-
Akron	53	27	1,415	68
Havana	15	21	130	14
Moundville Engraved				
Undetermined	4	169	437	41
Hemphill	-	83	315	7
Maxwells Crossing	-	2	-	-
Taylorville	-	26	79	25
Tuscaloosa	2	23	52	24
Wiggins	1	63	380	56
Moundville Incised				
Undetermined	8	541	2,631	37
Moundville	15	117	1,139	67
Snows Bend	15	100	1,615	26
Carrollton	80	1,811	5,699	140
Parkin Punctated				
Undetermined	2	41	305	34

BEAD LOCATION

The location of beaded strips around vessel rims and shoulders was thought to be possibly temporally sensitive. The distance of the beaded strips below the lip was measured. Because of the limited number found on the site, more data must be accumulated before further analysis is deemed appropriate for this attribute.

DECORATION LOCATION

The location of all decorations, whether interior or exterior, was noted. This category was particularly useful for description of the unclassified sherds. Both interior and exterior incising and painting were noted for unclassified sherds.

NUMBER OF INCISIONS

This attribute was described only for the primary design element of the Moundville Incised varieties. The primary design element consisted of lines which made up the arch motifs incised on the shoulders of the vessel.

The Mississippian and Protohistoric Types and Varieties

The ceramic descriptions which follow encompass the shell tempered and mixed shell and grog tempered ceramic assemblages found at the Lubbub Creek Archaeological Locality. Ceramic types will be described in alphabetical order, and unclassified material will be discussed at the end of this section.

The shell and shell and grog tempered ceramics comprised over 90 percent of the ceramics from the site by count and over 80 percent of the collection by weight. Counts and weights by type and variety and counts of diagnostic sherds by type and variety for the Phase I through III collections are given in Table 1. The diagnostic sherds are those used in the analysis of the attributes reported here. As a result of the attribute analysis of these Mississippian and Protohistoric ceramics, the author has been able to refine their descriptions and describe variation within these types and varieties.

The whole of these data are presented in Appendix G, Volume III.

ALABAMA RIVER APPLIQUE

Documentation: Cottier 1970; Sheldon 1974; Jenkins 1979a.

Background

When sherds of Alabama River Applique have been found on major Mississippian sites, they have often been combined with sherds of plain coarse shell tempered Mississippian types. Alabama River Applique vessels exhibit applique strips or false handles, but may also exhibit functional triangular luted handles in conjunction with the applique handles. In this study, if sherds of the Alabama River Applique type did not have attached applique strips or false handles, they could not be distinguished from sherds of Mississippi Plain *var. Warrior*. The applique strips on Alabama River vessels have been considered decorative rather than functional. Change in handle

added strength.

Bottom Handle Attachment

The attachment of the bottom of the handle to the vessel wall was also noted as either riveted or luted as described above. In cases where the attachment area was missing, this category was left blank and was thus indeterminate.

Handle Nodes

The placement and number of nodes found on Mississippian handles were thought to vary through time. To gather data to support or negate this theory, nodes were described for the upper, middle, and lower areas of handles.

Four possible node arrangements were noted for the upper area of the handle. These were: 1) a single horizontal bar node (Figure 9g), 2) a single node (Figure 9f), 3) double nodes (Figure 9h), and 4) triple nodes. For the middle area of the handle, only two node decorations were noted: 1) a single node (Figure 9j) and 2) a single vertical node (Figure 9k). Nodes on the bottom area included two forms on the lower area of the handle: 1) a single node (Figure 9l), and 2) a single horizontal node (Figure 9m), and also included were single nodes placed immediately below the handle on the vessel wall (Figure 9l-n).

LUG HANDLE METRICS

Width (Horizontal)

The measure of width referred to the maximum width of the lug handle at the point of wall intersection (Figure 10h).

Thickness (Vertical)

The thickness of the lug was measured at the point halfway between the lug's attachment to the vessel wall and the point of maximum extension (Figure 10j).

Extension (Horizontal)

The measure of lug extension was taken from the vessel wall to the lug's maximum point of extension away from the vessel wall (Figure 10i).

RIM SHAPE

This term refers only to the modification of the end point or lip of the vessel. Some rims were flattened (Figure 15a) by cutting away the uppermost portion of the rim; this left a flat surface rather than the round to angular lip usually found on Mississippian vessels. All rims were noted as either round or flat.

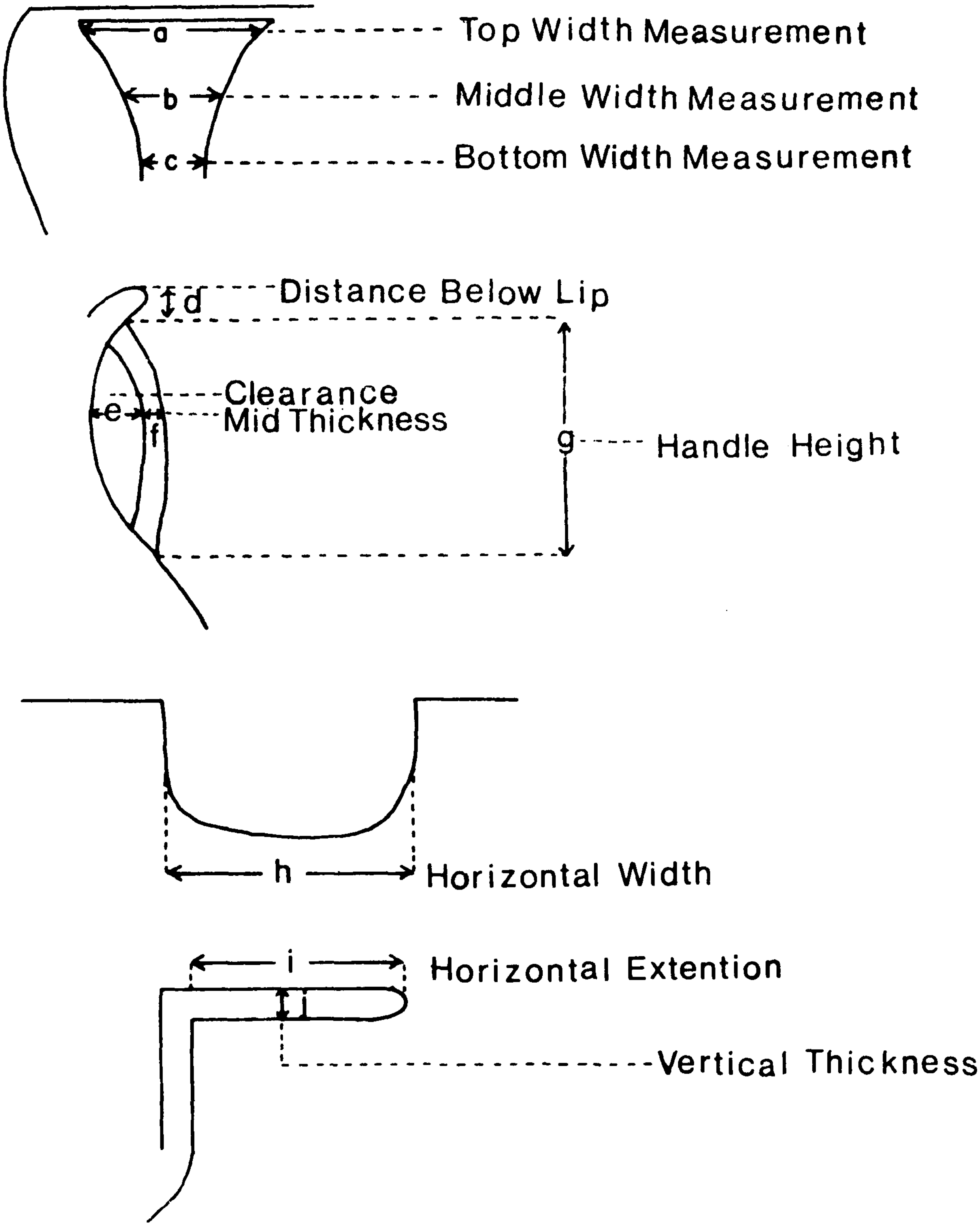


Figure 10. Handle measurements taken on strap, loop, and lug handles.

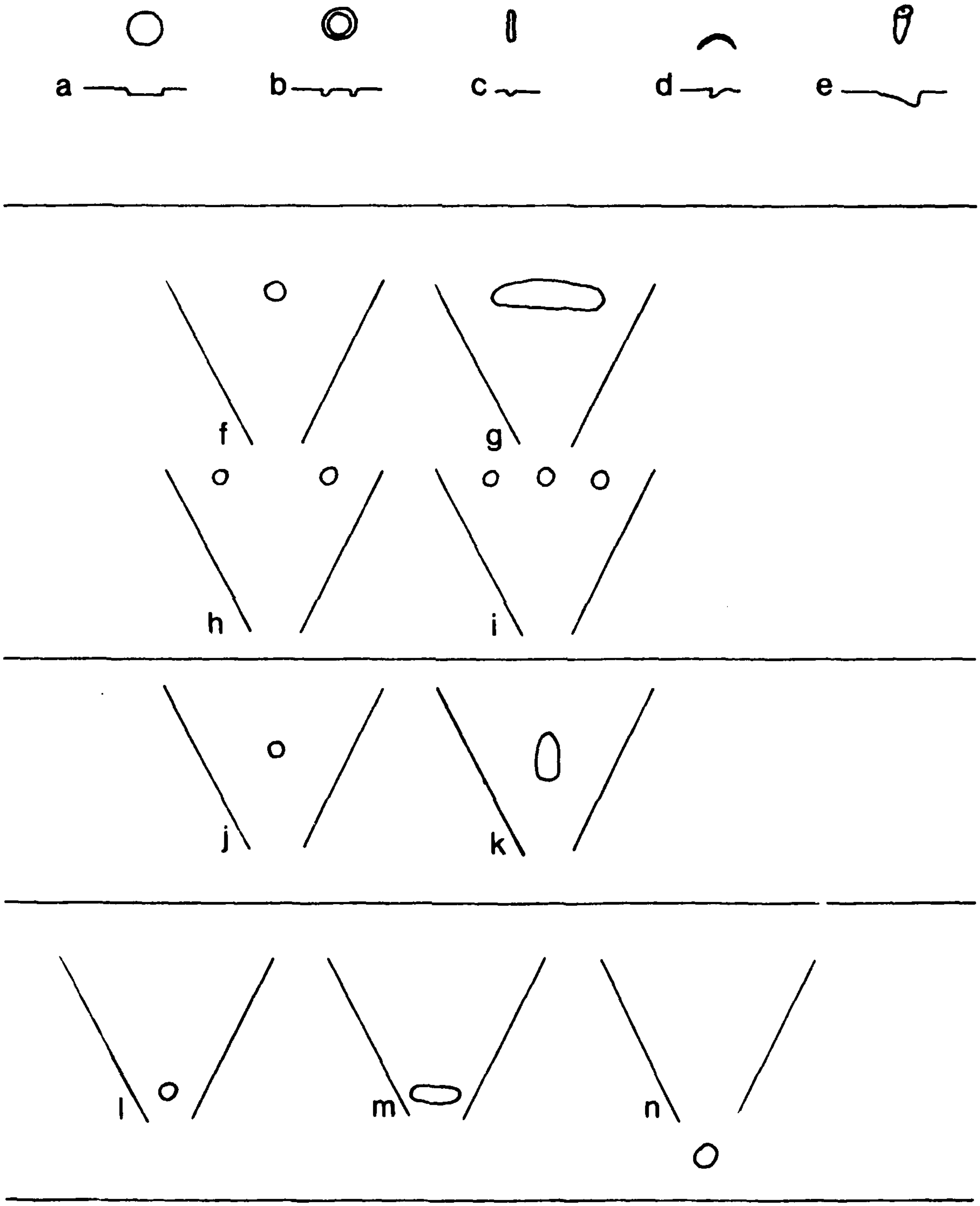


Figure 9. Punctate types found on the ceramics from the Lubbub Creek Archaeological Locality: a-e on body of vessel; f-n on handles.

Total Number on Vessel

When enough of the vessel was present to establish the total count of handles on it, this count was recorded. If more than 10 handles were present on a single vessel, the number 10 was used to mean "10 or more."

Top Width

At the point where the top of the handle intersected the vessel wall (Figure 10a), a measurement was taken of the maximum width of the handle.

Middle Width

The width of the handle was measured at a point midway between the top of the handle and the bottom of the handle (Figure 10b).

Bottom Width

At the point where the bottom of the handle intersected the vessel wall (Figure 10c), a measurement of handle width was taken.

Middle Thickness

At the same point on the handle profile at which the middle width was taken, the thickness of the handle was measured (Figure 10f).

Clearance

Clearance was the distance between the vessel wall and the interior surface of the handle (Figure 10e), measured at the same point used for middle thickness and middle width.

Height

The distance between the intersection of the handle with the neck or rim at the top and the shoulder at the bottom (Figure 10g) was measured as the handle's height.

Distance Below the Lip

This measured the distance between the end point and the point at which the top of the handle intersected the vessel wall (Figure 10d).

Top Handle Attachment

Handles were attached to the vessel walls by two methods in this collection: riveting or luting. In this study, riveted means the handle was attached through the vessel wall. Evidence on the interior of some vessels showed that a hole was cut in the vessel wall, then the handle was placed through the hole and the surrounding area was refilled and smoothed so that [illegible] of attachment were not usually evident. Luting as used in this study was the application of handles by pressing the attachment areas of the handles onto the vessel wall and rim. In this instance, the handle did not penetrate the vessel wall. Clay was molded around the points of attachment to give

PUNCTATE TYPE

Five types of punctations were noted on Mississippian wares in the Lubbub Creek collection. Two varieties of Moundville Incised were distinguished on the basis of type of punctation. In addition, "pinching" or curved punctations made with a crescent-shaped tool were present on Parkin Punctated vessels.

Round

A round punctation was a circular punctation with a flat interior surface area (Figure 9a).

Round with Raised Center ("Annular")

This punctation was circular with its central area remaining at the same level as the surface of the sherd (Figure 9b). Probably a hollow piece of cane was pressed into the vessel wall to form this impression. Many vessels of Moundville Incised var. Snows Bend have punctations of this type.

Straight

This was a punctation caused by pressing a straight-edged tool into the clay to form a straight line (Figure 9c). The tool which was used could have been a thin rectangular object less than one millimeter thick. This technique was sometimes used to produce the secondary design element usually referred to as the rays radiating from the arch motif on the Moundville Incised var. Moundville ceramics.

Pinched

Occasionally the rays described above appeared to have been applied with a fingernail or a crescent-shaped tool (Figure 9d). Also common in the Mississippian assemblage was a decorative design formed by completely covering the vessel's surface with this type of punctation. The latter decoration will be discussed further under the type Parkin Punctated.

Hemiconical

This type of punctation was made by pressing a round tool into the vessel wall at an angle rather than straight into the surface. This resulted in a semi-circular punctation which increased in depth as the tool moved away from the original point of contact with the vessel wall (Figure 9e).

PUNCTATE SIZE

This was a simple measurement of the longest dimension of the punctation.

HANDLE METRICS

When analysis was first begun on the ceramics from the Lubbub Creek Archaeological Locality, a number of attributes were noted as being possibly chronologically sensitive. Near the top of the list was variation in handle metrics. Eleven attributes of handles were either noted or measured.

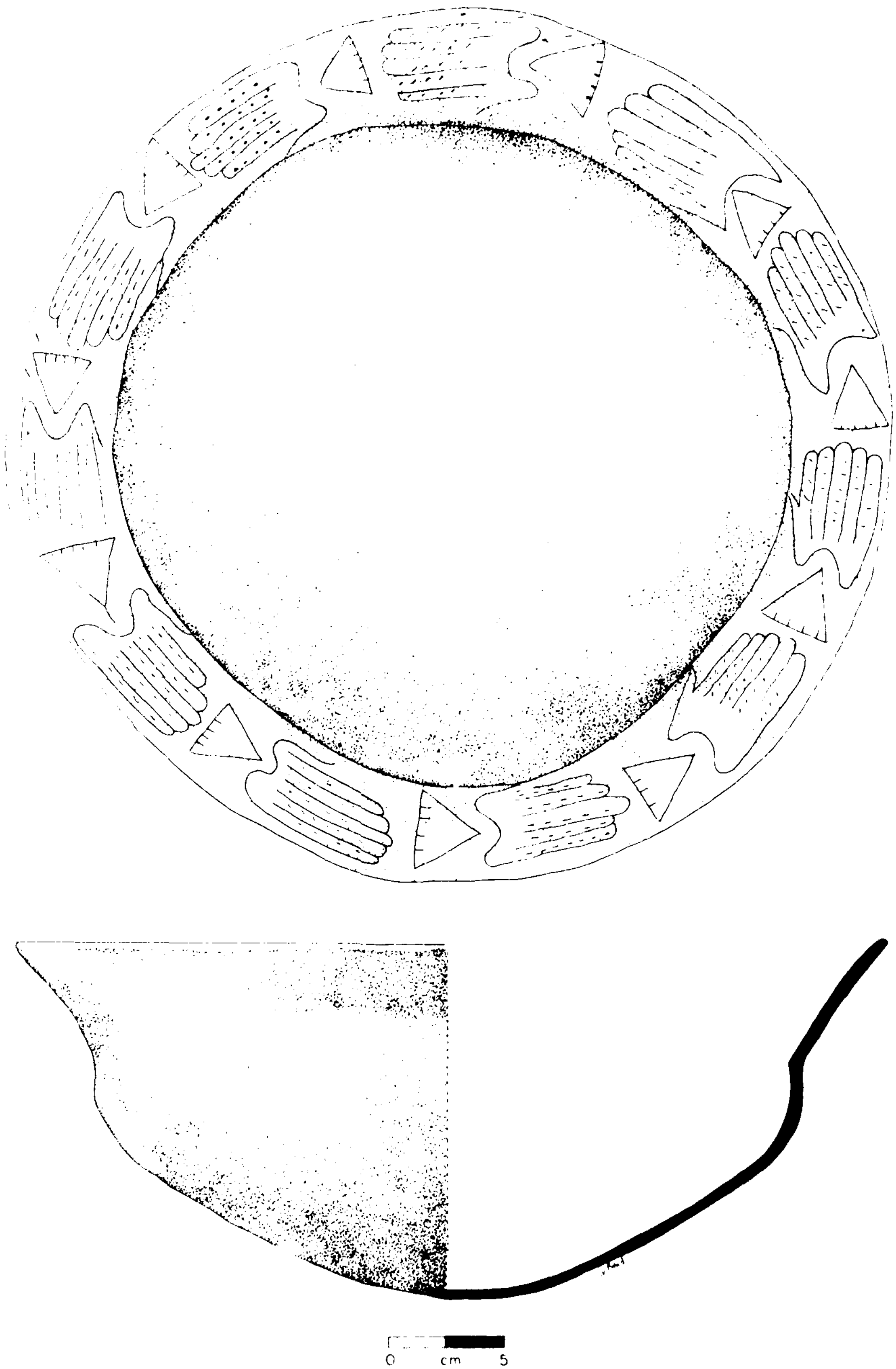


Figure 14. Alabama River Incised var. Alabama River, burial urn cover.

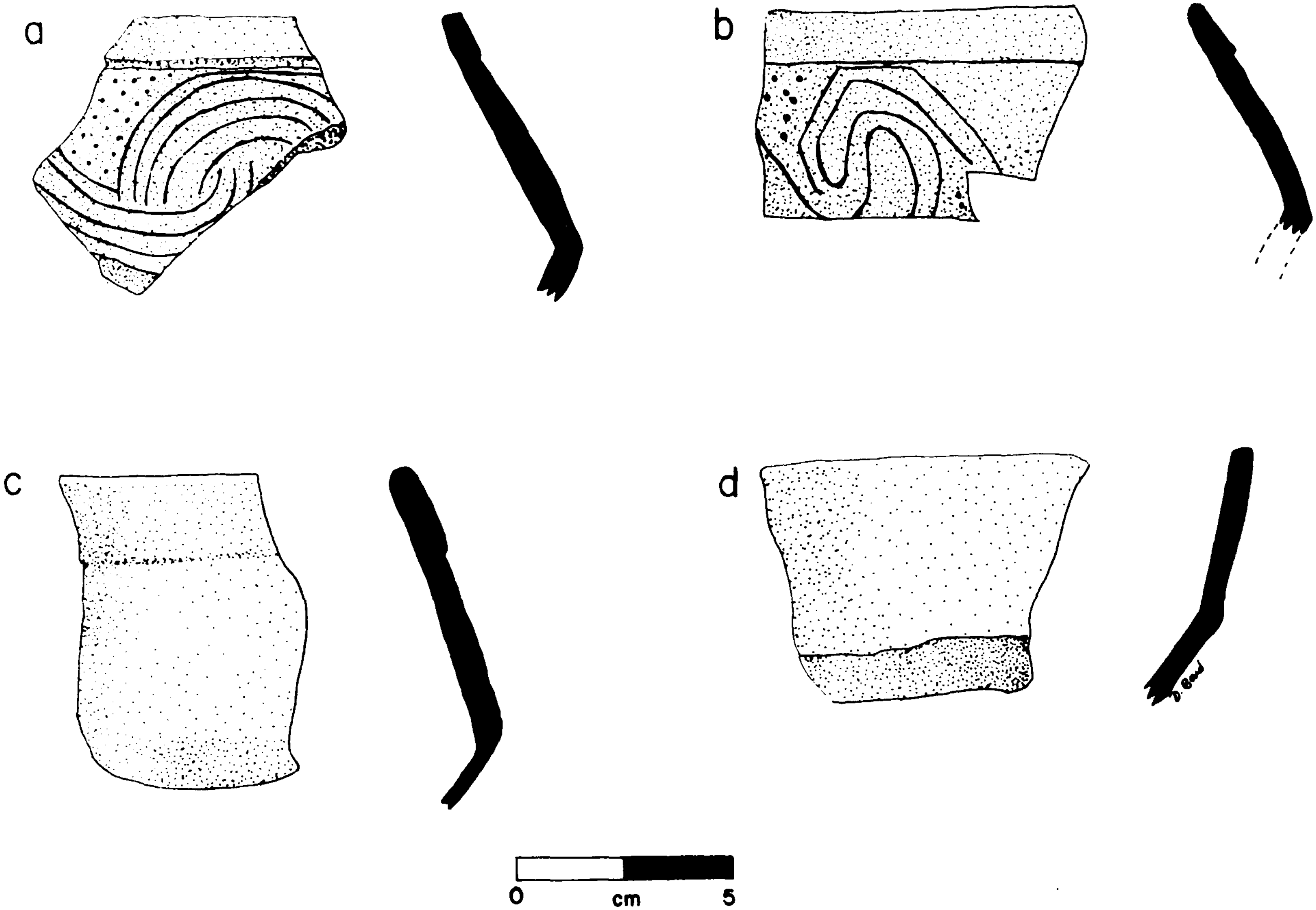


Figure 15. Alabama River Incised and Mississippi Plain carinated vessel fragments: a-b, Alabama River Incised var. Alabama River; c-d, Mississippi Plain var. Warrior.

unburnished and smoothed. The interior surfaces of three were also burnished, and three were unburnished and smoothed.

Comment

Because of the small amount of incised burial urn covers and other late incised wares, these ceramics were grouped in one category in this study. With a larger data base, these would almost certainly be assigned to different types or varieties. Both Carthage Incised var. Foster (Steponaitis 1980:95-97) and Foster Filmed Incised (Sheldon 1974:208-210) should be considered as elements in this loosely defined group.

BARTON INCISED

Documentation: Phillips 1970; Jenkins 1979a; Steponaitis 1980.

Background

Barton Incised ceramics, as described by Phillips (1970:44) have "carelessly executed linear patterns" incised on their exterior surfaces. These ceramics were infrequent at the Lubbub Creek Archaeological Locality. Only a few very eroded sherds which could be classified as Barton Incised var. Demopolis were found. This variety was described by Jenkins (1978:58-59) as having "a series of parallel lines...incised vertically from the lip." All possible examples were tempered with coarse shell. Because of the poor quality and small sample, further elaboration was not deemed advisable.

BELL PLAIN

Documentation: Phillips 1970; Jenkins 1979a; Steponaitis 1980.

Background

When Phillips (1970) established Bell Plain as a type, he stated "it would appear that uncertainty as to the exact nature of the paste is one of the characteristics of Bell Plain" (Phillips 1970:60). These shell tempered wares contained sufficient grog in the paste that some authors "gave it up and threw it into Baytown Plain" (Phillips 1970:60) rather than place this shell and grog tempered material into the shell tempered types.

In the Mississippian ceramic assemblage at the Lubbub Creek Archaeological Locality, a fine mixed shell and grog tempered ware was recognized. These materials conformed to the type description for Bell Plain rather than to descriptions of other Mississippian types for this area. The mixed shell and grog tempered wares whose temper particles were smaller than 2 mm were placed in Bell Plain var. Big Sandy (Jenkins 1979a).

Probable Relationships

Bell Plain var. Big Sandy is probably most closely related to Mississippi Plain var. Hale (see below) because it is only the addition of fine grog to the shell tempered paste which separates the two varieties. This variety is also very similar to Bell Plain var. New Madrid described by Phillips (1970:60).

Bell Plain var. Big Sandy

Sorting Criteria and Attributes

Bell Plain var. Big Sandy is distinguished from Mississippi Plain var. Hale by the addition of fine grog to a shell tempered paste. Mean temper size was 0.88 mm (n=71; s=0.81 mm). When Jenkins (1979a) set up the provisional var. Big Sandy, burnishing was included in the criteria for inclusion in this variety. In the present study, sherds were placed in this variety on the basis of temper and temper size, and burnishing was studied as a secondary attribute. Of the sherds studied (n=71), 82.9 percent were burnished on their exterior surfaces, 15.7 percent were unburnished and smoothed, and 1.3 percent were unburnished and scraped. Of the interior surfaces, 72.9 percent were burnished, 22.9 percent were unburnished and smoothed, and 4.3 percent were unburnished and scraped.

Of the 42 sherds for which vessel shape could be determined, 23.8 percent were from simple bowls, 21.4 percent from flaring rim bowls (4 of 9 were "deep profile"), 14.3 percent from bottles, 9.5 percent from restricted bowls, 9.5 percent from short neck bowls, 7.1 percent from miscellaneous bowls, 4.8 percent from outslanting bowls, 2.4 percent from miscellaneous jars, 2.4 percent from standard jars, 2.4 percent from cylindrical bowls, and 2.4 percent from terraced rectangular bowls.

Types which include simple bowls as a major vessel shape often have a high occurrence of rim effigies. Three sherds which were parts of effigy supports and a bird effigy (Bird I) were tempered with mixed fine shell and grog and were thus included in this variety.

Of the 71 var. Big Sandy sherds studied, 52.1 percent were smudged or blackfilmed on their exterior surfaces, and the surface condition of 47.9 percent could not be determined. Because there was a large number of bowl forms in this variety, it was not surprising that 75.7 percent of the sherds which were smudged or blackfilmed exhibited this treatment on both the interior and exterior surfaces.

Of the six bottle fragments identified, four were smudged on both their interior and exterior surfaces. This observation is interesting because bottles are generally thought not to be smudged on their interior surfaces. This could lead one to believe that the firing atmosphere played a more important part in the appearance of these vessels than has previously been believed.

Of the 41 rim sherds present, 19.5 percent were beaded, 7.3 percent were notched, and 2.4 percent were folded. Four horizontal lugs were noted for this variety. Of the six bases present, two were slab bases, two were pedestal bases, and two were simple bases.

Comments

In this study, the distinction was made between fine shell tempered wares and fine mixed shell and grog tempered wares in an effort to gain a better understanding of the Mississippian ceramics. The large number of mixed fine shell and grog tempered wares in this collection should promote the

establishment of Bell Plain var. Big Sandy as a legitimate variety; one which deserves further study.

CARTHAGE INCISED

Documentation: Steponaitis 1978, 1980; Jenkins 1979a.

Background

In earlier studies (DeJarnette and Wimberly 1941; McKenzie 1964, 1965, 1966), sherds of the type Carthage Incised were included in the type Moundville Filmed Incised. However, because of recent insight into the confusing realms of deliberate surface coloration and the numerous possible methods of application, the term "filmed" was deemed inappropriate, and Steponaitis (1978; 1980) classified these sherds as a new type, Carthage Incised.

Carthage Incised, as defined in this study, refers to a number of shell tempered incised wares which commonly have a burnished surface. The assignment of sherds to this type followed the criteria established for the Carthage Incised design configurations by Steponaitis (1980) with the exception of Steponaitis' Carthage Incised var. Akron. In this study, sherds which were classified by Steponaitis (1980) as var. Akron have been classified as Mound Place Incised, which was defined by Phillips, Ford, and Griffin (1951:147-148) and retained in Mississippian ceramic descriptions by Phillips (1970:135) and Jenkins (1979a:85). Discussion of this type will be found later in this section. The five other varieties of Carthage Incised -- var. Carthage, var. Fosters, var. Moon Lake, var. Poole, and var. Summerville -- defined by Steponaitis (1980:96) were used in this study.

The most important attribute of the Carthage Incised type is the broad trailed incision which constitutes the primary design elements of each variety configuration. When viewed in cross-section, the incised line had the shape of a wide "U". This broad U-shaped incision was applied to the vessel before burnishing or firing, because the trough of the line showed the same surface treatment as the non-incised surface areas of the vessels.

Probable Relationships

In the local Mississippian assemblages, Carthage Incised most closely resembles Mississippi Plain var. Hale in its paste which has a very low occurrence of mixed fine shell and grog as occurred in Bell Plain var. Big Sandy paste. In regard to the different design elements, Jenkins points to the possible relation of Carthage Incised to other material in the Southeast: "The different varieties of Carthage Incised are probably most closely related to Pensacola Incised (Willey 1949) which is centered in the Mobile Bay-Delta area (Willey 1949), and to Leland Incised and possibly Rhodes Incised of the Lower Mississippi Valley (Phillips 1970)" (Jenkins 1979a:66).

Carthage Incised var. Carthage: Figure 16; Moore 1907:Figure 68; Nance 1976:Figure 32e; Jenkins 1979a:Figure 3a-d; Steponaitis 1980:Figure 17b.

Sorting Criteria and Attributes

Carthage Incised var. Carthage is separated from the other Carthage Incised varieties by its two to five-line running [illegible] found on the exterior body surfaces of bowls (Figure 16) and bottles and the interior rim areas of flaring rim bowls. The lines varied in width from a minimum of 1.3 mm to a maximum of 3.7 mm. The mean line width for Carthage Incised var. Carthage was 2.36 mm (n=14; s=0.76 mm).

In the Lubbub Creek collection, most sherds of this variety were too small to identify the vessel form. The design configuration of this variety did appear on the exterior surfaces of simple and miscellaneous bowls.

The tempering material was shell in 92.9 percent of the 14 sherds studied and was mixed shell and grog in 7.1 percent. The temper size of the var. Carthage ceramics ranged from 0.5 mm to 2.0 mm. The mean temper size was 1.23 mm (n=14; s=0.56 mm). Of the 14 sherds studied, 85.7 percent were smudged or blackfilmed -- 58.3 percent of these on the exterior only and 41.7 percent on both the interior and exterior surfaces. Within this variety, only a small percent were too eroded for identification of deliberate surface coloration. All exterior surfaces were burnished, but only 42.9 percent of the interior surfaces were burnished; the remaining 57.1 percent of the interior surfaces were smoothed but not burnished.

The only secondary shape feature noted for this variety was horizontal lugs. In the sample only one lug was found attached to the vessel wall of a Carthage Incised var. Carthage sherd. But the number of lugs found unattached in the total collection and the occurrence of rim area breaks on the var. Carthage sherds strongly suggests that the horizontal lug was a common attribute of this variety.

Comments

Carthage Incised var. Carthage represents one small fragment of the complex ceramic assemblages associated with the Mississippian centers in Alabama. This variety appears to have first occurred in the early Summerville II period at the Lubbub Creek Archaeological Locality. Because it exhibited a new technique of decoration application, it may reflect an early increase in ceramic complexity in the Mississippian ceramic assemblage. The design motif was simple, but more complex motifs are evident in related varieties which occurred later in the chronological seriation of the ceramics.

Carthage Incised var. Fosters: Jenkins 1979a:Figure 31j; Steponaitis 1980:Figure 17c.

Sorting Criteria and Attributes

Carthage Incised var. Fosters was distinguished in the collection from the Lubbub Creek Archaeological Locality from the other Carthage Incised varieties by its free-standing representational motifs which consisted of hands, skulls, or death heads [illegible] long bones. These decorative motifs occurred predominately on the [illegible] of flaring rim bowls, and [illegible] had a low occurrence on bowl forms whose shapes were indeterminate. The line widths of the motifs ranged from 1.2 mm to [illegible] mm. The mean line width

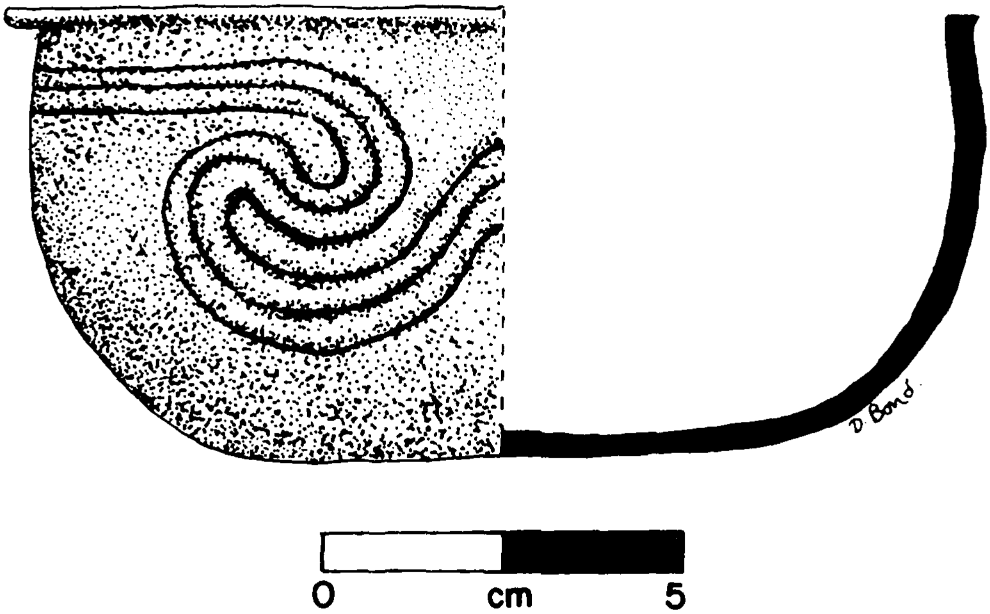


Figure 16. Carthage Incised var. Carthage, simple bowl form with horizontal lug handle.

of the material measured was 2.36 mm (n=8; s=0.68 mm). The tempering of the paste of this variety was composed entirely of fine shell; there were no occurrences of mixed fine shell and grog noted. The fine shell tempering ranged from 0.4 mm to 1.6 mm in size; the mean temper size was 0.94 mm (n=8; s=0.39 mm).

Smudging or blackfilming was the only deliberate surface coloration noted for the eight sherds of this variety. Both the interior and exterior surfaces of 83.3 percent of the sherds were smudged or blackfilmed, and 16.7 percent were smudged or blackfilmed on the exterior surface only. The exterior surfaces of 87.5 percent were burnished, and one sherd, from a flaring rim bowl, exhibited the qualities of being unburnished and scraped on the exterior. Of the interior surfaces examined, 62.4 percent were burnished and [illegible] percent were unburnished and scraped.

Only one secondary shape feature of Carthage Incised var. Fosters was noted -- a folded rim on a flaring rim bowl. Because of the limited amount of data concerning this attribute at the present time, it is not known whether this attribute fell early or late in the seriation. The author firmly believes that continued research will show that this attribute falls late.

Comments:

Carthage Incised var. Fosters is a complex broadline incised ware which was subsumed in earlier works under the type Moundville Filmed Incised (DeJarnette and Wimberly 1941; McKenzie 1964, 1965, 1966). This variety reached its largest numerical significance during Late Summerville III. The data indicate that this variety had a temporal span which continued through Summerville III and possibly was the proto-type for the later Alabama River Incised wares. These wares differ only in surface treatment, state of the vessel paste when incised, and shape of the tool used for the incision.

Carthage Incised var. Moon Lake: Figure 17; Jenkins 1979a:Figure 3e-h; Steponaitis 1980:Figure 17d.

Sorting Criteria and Attributes

The design motif of var. Moon Lake is described by Jenkins (1979a:68) as "zones of parallel oblique lines, which usually occur on the interior of flaring rim bowls or on the exterior shoulder of short necked bottles."

In the collection of 54 rim sherds recovered from the Lubbub Creek Archaeological Locality, 87.0 percent of the Carthage Incised var. Moon Lake motifs occurred on flaring rim bowls. Outslanting bowl forms accounted for 3.7 percent of the sherds of this variety, and 9.3 percent were identified as from a bowl form whose exact shape could not be determined.

The minimum line width of the incision was 0.6 mm and the maximum line width was 3.7 mm; the mean line width for var. Moon Lake was 1.44 mm (n=55; s=0.68 mm).

All sherds of Carthage Incised var. Moon Lake were shell tempered and [illegible]. Temper size ranged from 0.4 mm to 2.7 mm. The mean temper size was [illegible] mm (n=54; s=0.34 mm). The mean temper size of this

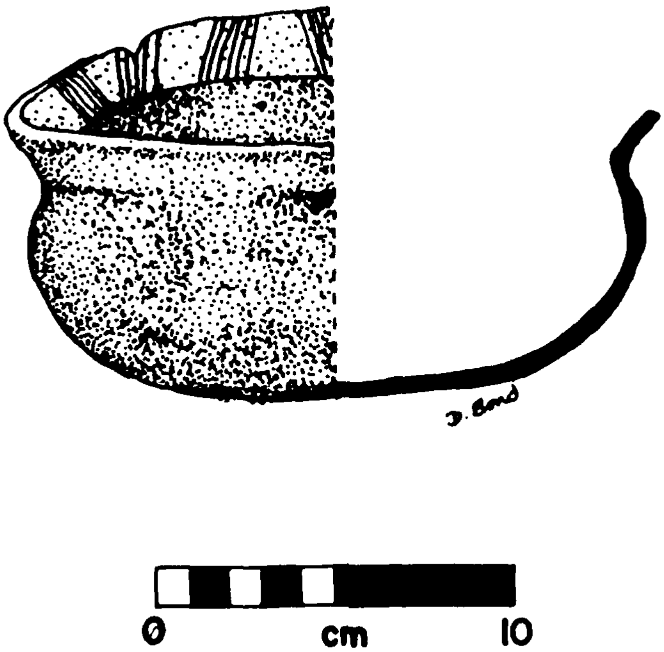


Figure 17. Carthage Incised var. Moon Lake, deep profile flaring rim bowl.

ty was the largest of any variety of the type Carthage Incised found at ubbub Creek Archaeological Locality.

The sixteen sherds (29 percent) which exhibited deliberate surface ation were deemed smudged or blackfilmed. Of the sherds which were ged or blackfilmed, 70.6 percent exhibited treatment on both the interior exterior surfaces, 23.5 percent were smudged or blackfilmed on the ior surface only, and 5.9 percent exhibited smudging or blackfilming on exterior surface only. Of 54 sherds with uneroded exterior surfaces, 57.4 ent of the sherds were burnished, and 42.6 percent were unburnished and hed. Of 55 complete interior surfaces of this variety, 69.1 percent were shed, 29.1 percent were unburnished and smoothed, and 1.8 percent were nished and scraped.

Secondary shape attributes which occurred in this variety were all ications of the rim area or body wall. One rim sherd had a simple folded which was a method for thickening the rim area. Another rim sherd of variety had a folded flattened rim. In this instance, the end point of folded rim was modified to give a flat or bevelled appearance. Six of the laring rim bowls of this variety had a "deep profile." It should be noted these secondary attributes were observed on only a small percent of the nics of this variety, but their occurrence should be noted for further ies as more data are recovered.

ents

When the var. Moon Lake sherds were grouped with other flaring rim bowl ds which were incised on their interior surfaces, the Unclassified rior Incised sherds with simple rectilinear designs were found to greatly mble the Carthage Incised var. Moon Lake sherds because they had oblique llel lines on their interior rims. These materials were placed in the assified category because the incisions were not performed on a leather- surface as required for inclusion in the Carthage Incised type. Six ples of this unclassified material were incised on a wet paste. This gave wares a rather sloppy appearance rather than the uniform appearance of Moon Lake. The line width of the incisions performed on a wet paste ed from 1.2 mm to 2.8 mm, with a mean of 1.73 mm (n=6; s=0.64 mm). The ining 12 examples of the simple rectilinear unclassified wares were sed on a bone dry paste. These incisions were usually very ragged in arance with the sides of the incisions broken and irregular because the of incision was forced through a clay surface which was too dry to allow movement of the tool. The bone dry simple rectilinear incisions had a mum line width of 0.4 mm and a maximum line width of 1.6 mm. The mean h was 0.83 mm (n=12; s=0.36 mm).

Because of the extreme similarities between Carthage Incised var. Moon design elements and the design elements of the Unclassified Interior sed material with simple rectilinear designs, the author believes that tage Incised var. Moon Lake might possibly be given type status outside type Carthage Incised in order to allow the grouping of all variations of similar design elements under a single type. In this study, the assified Interior Incised wares with simple rectilinear designs incised on t or bone dry paste were combined with the Carthage Incised var. Moon Lake so that variation in the design could be examined.

Carthage Incised var. Summerville: Jenkins 1979a:Figure 63; Steponaitis 1980:Figure 17f.

Sorting Criteria and Attributes

Carthage Incised var. Summerville was distinguished by its incised lines which formed arches around the exterior shoulders of bottles and restricted bowls. Steponaitis (1980:97) stated that "at Moundville, this variety usually occurs on restricted bowls." Jenkins recovered one pedestalled bottle of this variety during excavations at Site 1Pi33, a site within the Lubbub Creek Archaeological Locality. Only one example of Carthage Incised var. Summerville was recovered from the Lubbub Creek Archaeological Locality during the University of Michigan excavations. This fragment was identified as the shoulder fragment of a restricted bowl. The line width measured 1.4 mm and was applied to a shell tempered vessel. The third largest temper size measured 1.0 mm.

The eroded condition of the sherd made observations of deliberate surface coloration and surface treatment unfruitful. The incision seemed to have been performed on a wetter paste than would be expected. But because this observation was made on a single sherd and because of the condition of the sherd, further comment should be withheld until observation of a larger collection is possible.

Only a single secondary shape attribute was noted for this variety -- a beaded rim. The beaded rim is most often associated with types which are smudged or blackfilmed and which have a burnished surface. The occurrence of a beaded rim on this eroded sherd increased the possibility that the sherd was either burnished, smudged or blackfilmed, or both.

Comment

The very limited sample size precludes further comment on this variety at this time.

Carthage Incised var. Poole: Steponaitis 1980:Figure 17c

No examples of this variety as described by Steponaitis (1980:97) were recovered from the Lubbub Creek Archaeological Locality.

KIMSWICK FABRIC IMPRESSED

Documentation: Walker and Adams 1946; Heimlich 1952; Jenkins 1979a; Trickey 1958.

Background

The two examples of shell tempered fabric impressed ceramics recovered from the Lubbub Creek Archaeological Locality during the 1979 excavations did not fall easily within the definition of Kimswick Fabric Impressed first presented by Walker and Adams (1946). The ceramics from the Lubbub Creek Archaeological Locality were impressed with what appeared to be woven cane (Figure 30k-l) rather than a fabric of twined or twisted cordage. Ceramics impressed with fabric in the Tennessee Valley were described as Langston

Impressed by Heimlich (1952:26). Jenkins (1979a:71) found one sherd of impressed pottery from Site 1Pi33 in the Lubbub Creek Archaeological y during the 1977 excavations and classified it as Kimswick Fabric ed var. Langston. This sherd was impressed with fabric of twined or cordage, in contrast to the cane impressed sherds under study for this Cane impressed wares have been noted in the Mobile Bay-Delta area and ed as Mobile Cane Impressed by Trickey (1958).

e author believes the cane impressed wares should be noted, but not variety status until more examples and a better understanding of these s is established. Given this rationale, the woven cane impressed s shall be referred to in this manuscript as Kimswick Fabric Impressed specified. This is in keeping with the proposal by Phillips (1970:95) all salt pan fabric impressed pottery in the Southeast be classified in e type category." Fabric impressed bowls have been referred to as pan" wares because they are commonly found at prehistoric salt ing sites (Jenkins 1979a:71).

Criteria and Attributes

at bowls were the only vessel shape with this decoration. The sherds swick Fabric Impressed var. Unspecified were unburnished on both their r and exterior surfaces, and the cane impressions were on the exterior of each example. The paste was tempered with coarse shell, with a size of 2.5 mm and a maximum size of 2.7 mm.

single secondary shape attribute was noted for this variety. The rim f one sherd was thickened at the end point. Thickening in this fashion t pan" wares is a common attribute in the Mobile Delta (Trickey 2).

s

cause of the small sample and the context from which the material was ed, inclusion of this type in the chronological seriation was not e. Kimswick Fabric Impressed is thought to be most important during ndville III period. The woven cane impressed variety, which appears to ted to downriver coastal area wares (Coblentz, personal communication), twisted cordage open weave impressed wares, which are commonly found Tennessee Valley of northern Alabama, were possibly a result of trade. rther research will yield a clearer understanding of this material.

IPPI PLAIN

tation: Phillips 1970; Steponaitis 1978; Jenkins 1979a.

und

ssissippi Plain is a ceramic type which is destined to play an nt role in the understanding of the complex Mississippian developments southeastern United States. In early research at Mississippian sites tral Alabama, a coarse shell tempered, undecorated type called Warrior as noted (DeJarnette and Wimberly 1941; McKenzie 1964, 1965, 1966). when describing considerations which supported the establishment of

the so-called "super type" Mississippi Plain, noted it as "the name of a type of vast dimension that will not let itself be contained even within the areas of the Central and Lower Mississippi Valley" (Phillips 1970:131). The ceramics formerly called Warrior Plain in the Moundville area of central Alabama fall well within the type Mississippi Plain. Following the lead of Steponaitis (1978; 1980) and Jenkins (1979a), the coarse, shell tempered, undecorated ceramics from the Lubbub Creek Archaeological Locality have been classified as Mississippi Plain var. Warrior.

There are differences between this study and prior studies with regard to the type Mississippi Plain. Because of new data (Steponaitis 1980; van der Leeuw, appendix) which indicate the importance of temper size to the function of the vessel, the author felt that a distinction should be made, without regard to surface coloration and treatment, between coarse and fine shell tempered undecorated wares. In this study, Mississippi Plain var. Warrior includes all coarse shell tempered ceramics, whether burnished or unburnished. Steponaitis (1980) and Jenkins (1979a) included all unburnished shell tempered wares in var. Warrior. Burnished fine shell tempered wares were classified as Bell Plain var. Hale by Jenkins (1979a) and Steponaitis (1980). Steponaitis also included fine shell and grog tempered wares in Bell Plain var. Hale, but Jenkins classified these wares as Bell Plain var. Big Sandy. In this study, fine shell tempered wares, burnished or unburnished, were classified as a new variety, Mississippi Plain var. Hale, and fine shell and grog tempered wares were placed in Bell Plain var. Big Sandy. Classification of the coarse shell and grog tempered ceramics as Mississippi Plain var. Hull Lake follows Steponaitis (1980) and Jenkins (1979a). Analysis in this manner allowed for variation to be described for the coarse and fine shell tempered and shell and grog tempered wares independent of the categories in which they had previously been placed.

Surface coloration and treatment had a high correlation with the fine tempered wares, but 58 percent of the 237 var. Hale sherds subjected to attribute analysis were not smudged on their exterior surfaces, and 49.2 percent of the 71 var. Big Sandy sherds were not. These sherds would previously have been placed in varieties whose technological traditions of manufacture differed greatly from their own. The analysis format used in this study in regard to these types and varieties has proven useful and informative and has allowed comparison of this data with prior research.

In the material recovered from the Lubbub Creek Archaeological Locality, the var. Hull Lake was not especially useful as a ceramic category. The only identified inclusions in sherds of this variety were small shell tempered grog inclusions which were not in a crushed state but were rather small round nodules of clay which would have been common in any ceramic workshop area. With the exception of this material, no mixed coarse shell and grog tempered material was recovered.

Probable Relationships

The Mississippi Plain ceramics recovered from the Lubbub Creek Archaeological Locality are most closely related to the plain shell tempered ceramics found to the east at Moundville and to the west at the Kellogg Site. At the present time, there is no way to distinguish plain shell tempered ceramics from central Alabama from those recovered from the Tennessee Valley

ıern Alabama or those referred to as Penascola Plain by Willey (1949) : Mobile Bay-Delta area of southern Alabama.

ppi Plain var. Warrior: Figures 18-27; D(ırnette and Peebles 105, 111, 113-114; Jenkins 1979a:59-61, 65; Steponaitis 1980:291.

Criteria and Attributes

ssissippi Plain var. Warrior was sorted on the basis of lack of on on both the interior and exterior surfaces and shell tempering ıs 2 mm or larger. Of the 14 possible vessel shapes, 11 of these were noted from sherds or vessels classified as var. Warrior. Of 358 ›ly complete sherds, the vessel shapes comprised 24.8 percent ıneous jars, 19.3 percent simple bowls (Figure 18, 19, 20, 25), 16.2 standard jars, 10.1 percent miscellaneous bowls, 8.1 percent ing bowls, 7.5 percent short necked bowls (Figure 21, 22, 23, 24), 7.3 flaring rim bowls, 3.1 percent restricted bowls, 2.8 percent bottles 26), 0.8 percent cylindrical bowls, and 0.3 percent neckless jars. It en been noted that most of the Mississippi Plain var. Warrior material bowl and jar forms. In this study, 97 percent of the total sample d fell within these categories. The remainder of the material was from forms which were common in types and varieties composed of the finer d material. Such variation within a type must be expected, because being observed is the end product of a human activity which is as e as the tasks for which the vessel would be used and the individual ing the act. Most attributes which determine a type can and must be variability. Mississippi Plain var. Warrior has long been viewed as in, possibly smoothed, but never burnished or blackfilmed or smudged (Steponaitis 1980:97). When the ceramics were classified by temper per size and not by what this author deems secondary attributes, the lity of the coarse shell tempered wares became evident. The ceramics ied as Mississippi Plain var. Warrior were by and large just as they een described by Steponaitis (1980). But 7 percent had a smudged or lmed surface on a coarse shell tempered paste. The variable factors types should be noted, so that as refined seriations become available ese sites which exhibit extended occupations, changes within the assemblages may be better understood.

e exterior surfaces of 84.6 percent of the 604 var. Warrior sherds were unburnished and smoothed, 14.2 percent were burnished, and 1.2 were unburnished and scraped. Of the 595 interior surfaces studied, rcent were unburnished and smoothed, 13.9 percent were burnished, and rcent were unburnished and scraped. Thirteen effigies made from rrior paste were recovered; these are illustrated in Figure 7b,d,g-k.

ssissippi Plain var. Warrior exhibited the largest number of secondary features found within any variety except Mississippi Plain var. Hale, xhibited an equal number. The most common secondary attributes were ations or additions to the upper body or rim area of the vessel. ations of the 439 rims studied were folded rims on 2.3 percent of the erds examined, folded flattened rims on 1.4 percent, beaded rims on 3.2 , scalloped rims on 1.4 percent, and notched rims on 1.8 percent. ifferent handle forms were noted: downturned lugs on 0.8 percent of the s analyzed, horizontal lugs on 2.6 percent, and loop or strap handles

:he author's knowledge, the application of deliberate surface
ı to a vessel neither increases nor decreases the vessel's ability to
thermal shock or other stress a vessel must survive before the
ing process is complete. Because such factors which do help ensure
val of the vessel must be viewed as primary factors, coloration was
secondary attribute, though a very important attribute in
ding the way in which the potters themselves viewed the different
eramics they made. In the Mississippi Plain var. Hale ceramics,
surface coloration in the form of smudging or blackfilming did play
tant role. Over 44 percent of the ceramics studied as Mississippi
. Hale were smudged or blackfilmed. Of these, 73.3 percent were
or blackfilmed on both the interior and exterior surfaces, 21.0
ı the exterior surface only, and 5.7 percent on the interior only.

33 sherds with uneroded surfaces, the exterior surfaces of 72.1
were burnished, 27.5 percent were unburnished and smoothed, and 0.4
ere unburnished and scraped. Of the interior surfaces, 64.4 percent
nished, 31.6 percent were unburnished and smoothed, and 4.0 percent
rnished and scraped.

issippi Plain var. Hale exhibited a large number of secondary shape
s, equaled only by var. Warrior. Rim modifications in this variety
folded rims on 2.6 percent of the 158 rim sherds studied, folded
rims on 3.2 percent, beaded rims on 17.4 percent, scalloped rims on
nt, and notched rims on 3.9 percent.

ndary features found on the shoulder or upper body included beaded
on 1.7 percent of the 158 sherds studied, indentations on 0.4
and widely spaced applique nodes on 2.5 percent. Of the flaring rim
el form, one of the two examples was of the "deep profile" type.

zontal lug handles were present on 2.5 percent of the sherds, but
re noted on many sherds, which may indicate a higher frequency than
r of attached lug handles indicates.

gies (Figure 7a, c, e, f, j) included frog, fish, bird, human, and
uirrel representations.

only variation from the simple bases noted for most of the var. Hale
recovered was the occurrence of two pedestal bases in the collection
8). The slab bases from the total collection were so eroded and
at their classification as to type and variety could not be
d. Of all possible varieties, they probably occurred in var. Hale.

iewing the material recovered from the aspect of attributes, a better
ding of the ceramics can be gained. The occurrence within this
f the miscellaneous jar and standard jar forms served to point to the
in established varieties which can only be measured by studies of
. Mississippi Plain var. Hale is one of the most important
pian varieties which need to be understood. The approaches to
ding the variation in the fine tempered wares which have been used in
have been useful, but for progress to continue, more analysis on the

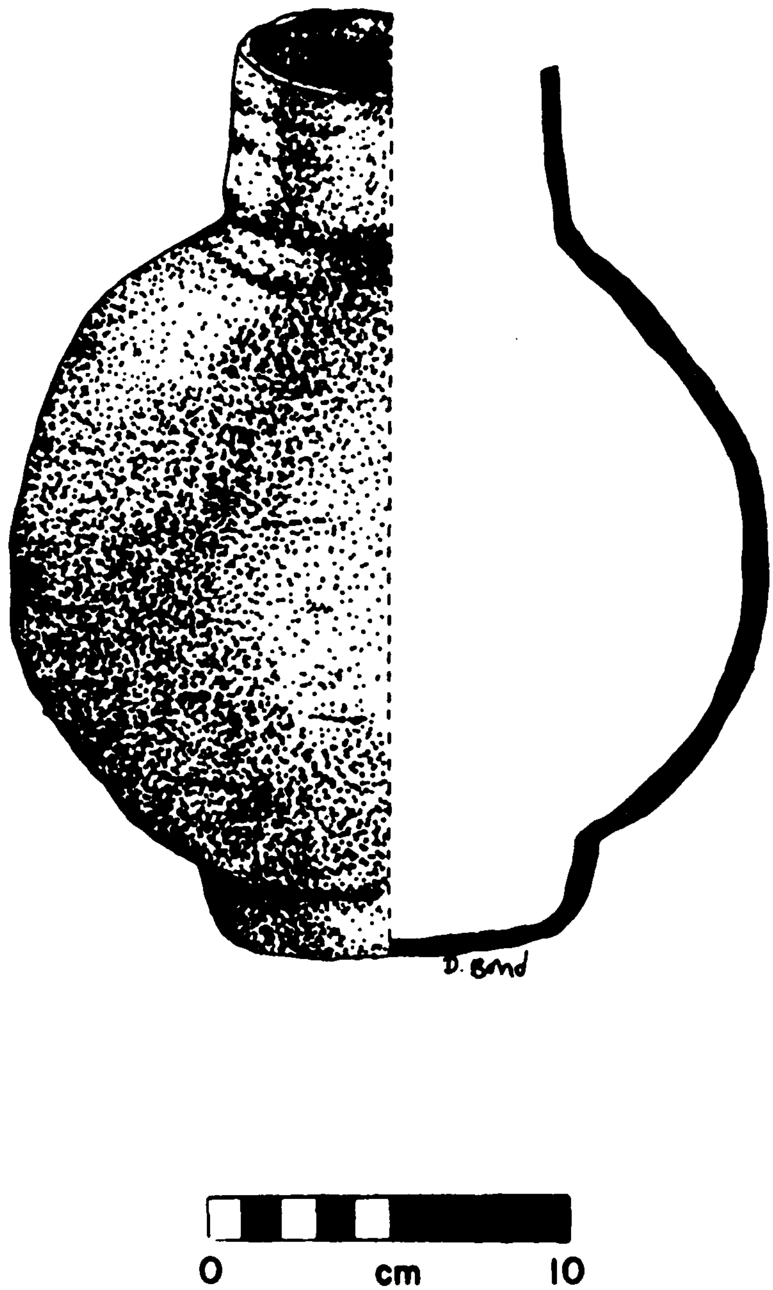


Figure 28. Mississippi Plain var. Hale, subglobular bottle.

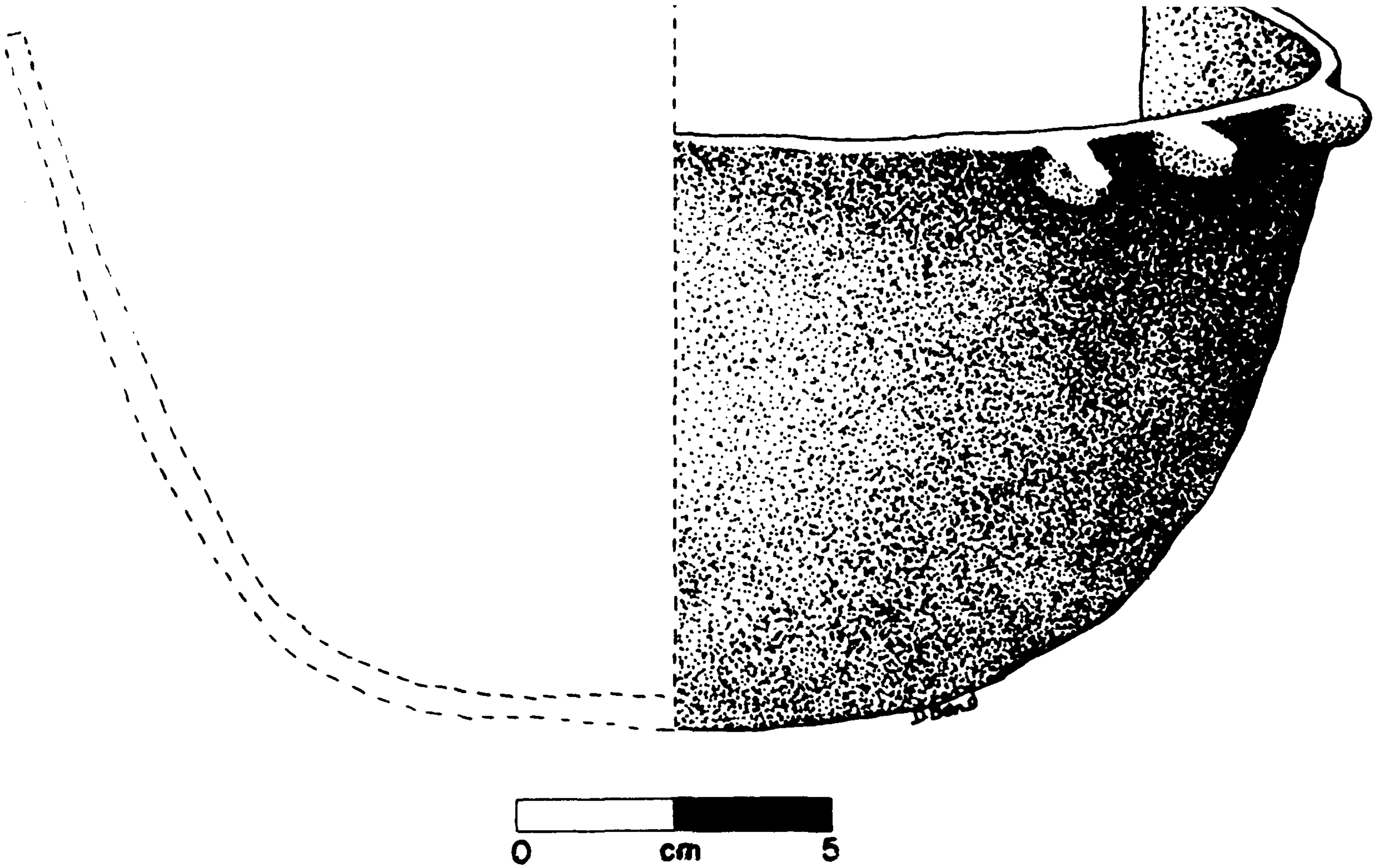


Figure 27. Mississippi Plain var. Warrior, simple bowl with uncommon noded arrangement on exterior rim area.

TABLE 3

Sample Statistics for Mississippi Plain *var.* *Warrior* Handles.

	N	Minimum (mm)	Maximum (mm)	Mean (mm)	Standard Deviation (mm)
Top Width	115	5.3	81.3	29.29	14.11
Middle Width	106	7.5	35.9	20.21	6.58
Bottom Width	79	3.9	32.3	18.16	6.35
Middle Thickness	129	4.1	15.4	8.32	2.21
Clearance	44	4.5	26.5	12.72	4.65
Height	50	3.6	77.6	48.06	15.45
Distance Below Lip	20	1.5	30.0	6.93	6.74

+.1 percent. The loop or strap handles were found to be the most itive to temporal change. In Summerville I context, the predominant le form was a loop handle which was round in cross-section and which was ted to the vessel wall at both the top and bottom. By Summerville II, the le became more flattened or strap-like and often one handle attachment was d and the other was riveted. By Summerville III the handle was ngular, wide at the top, narrow at the bottom, and very flat in cross-ion. The number of handles per vessel increased towards terminal erville III and continued to be a dominant factor in Protohistoric times. e 3 presents the sample statistics for all the var. Warrior handles spective of period.

Beaded shoulders were noted for only 0.3 percent of the 607 sherds of variety selected for attribute analysis. Of the flaring rim bowls which rised 7.3 percent of the sample, 19.2 percent exhibited a "deep profile." last secondary shape attribute noted for this variety was the placement of s on the shoulder or rim area of the vessels (Figure 27). These nodes present on 4.8 percent of the sample selected for attribute analysis.

ent

Although Mississippi Plain var. Warrior has always been the major ceramic ety associated with any Mississippian occupation, variations within the ety have been viewed as too minor to warrant further study. Today, with understanding of the technological processes related to complex ceramic itions evident in the Mississippian assemblages, every attribute must be rved and recorded. To gain a further understanding of such complex eties as Mississippi Plain var. Warrior, new approaches must be pursued. ibute analysis appears to be one step in that direction.

issippi Plain var. Hale: Figure 28.

ing Criteria and Attributes

Mississippi Plain var. Hale was separated from Mississippi Plain Warrior on the basis of temper size. Sherds whose third largest temper icles were less than 2 mm in size were classified as var. Hale. Of the 14 ible vessel forms, 10 forms were represented by 153 sherds of this ety; 32.0 percent of the sherds were from simple bowls, 15.0 percent were flaring rim bowls, 13.7 percent were from miscellaneous bowls, 11.1 ent were from bottles, 9.8 percent were from restricted bowls, 6.5 percent from outslanting bowls, 5.9 percent were from miscellaneous jars, 3.3 ent were from short neck bowls, 1.3 percent were from cylindrical bowls, 1.3 percent were from standard jars. In this variety, bowl forms were the common, comprising almost 82 percent of the vessel shapes represented. forms were much less common than in Mississippi Plain var. Warrior, and e was a higher occurrence of bottle fragments in var. Hale than in Warr . The selection of fine shell tempered paste for bottle forms as sed to coarse shell tempered paste for the jar forms of var. Warrior ably reflects decision making during vessel construction, which implies truction for a specific purpose or range of uses compatible with the anical properties -- the temper size and paste composition -- of the el.

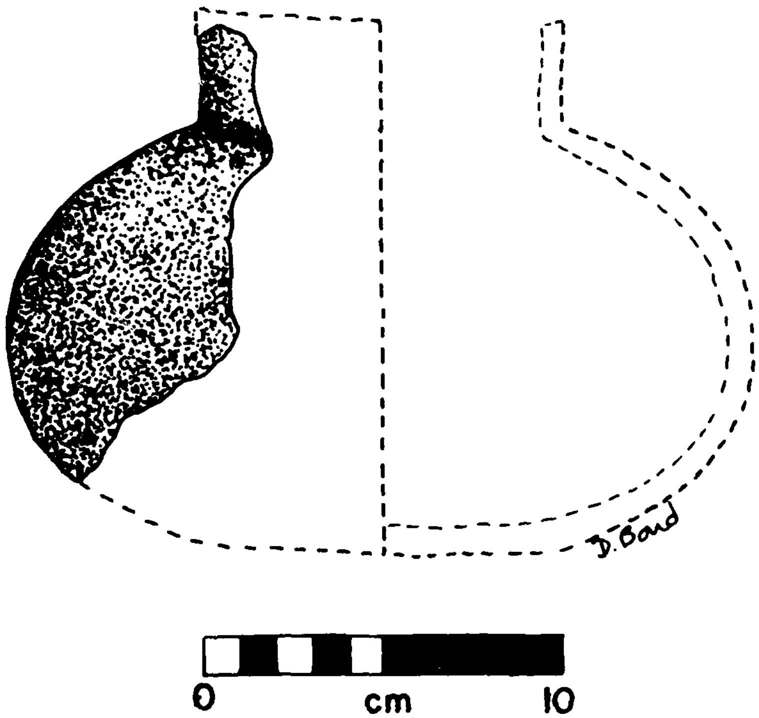


Figure 26. Mississippi Plain var. Warrior, subglobular bottle fragment.

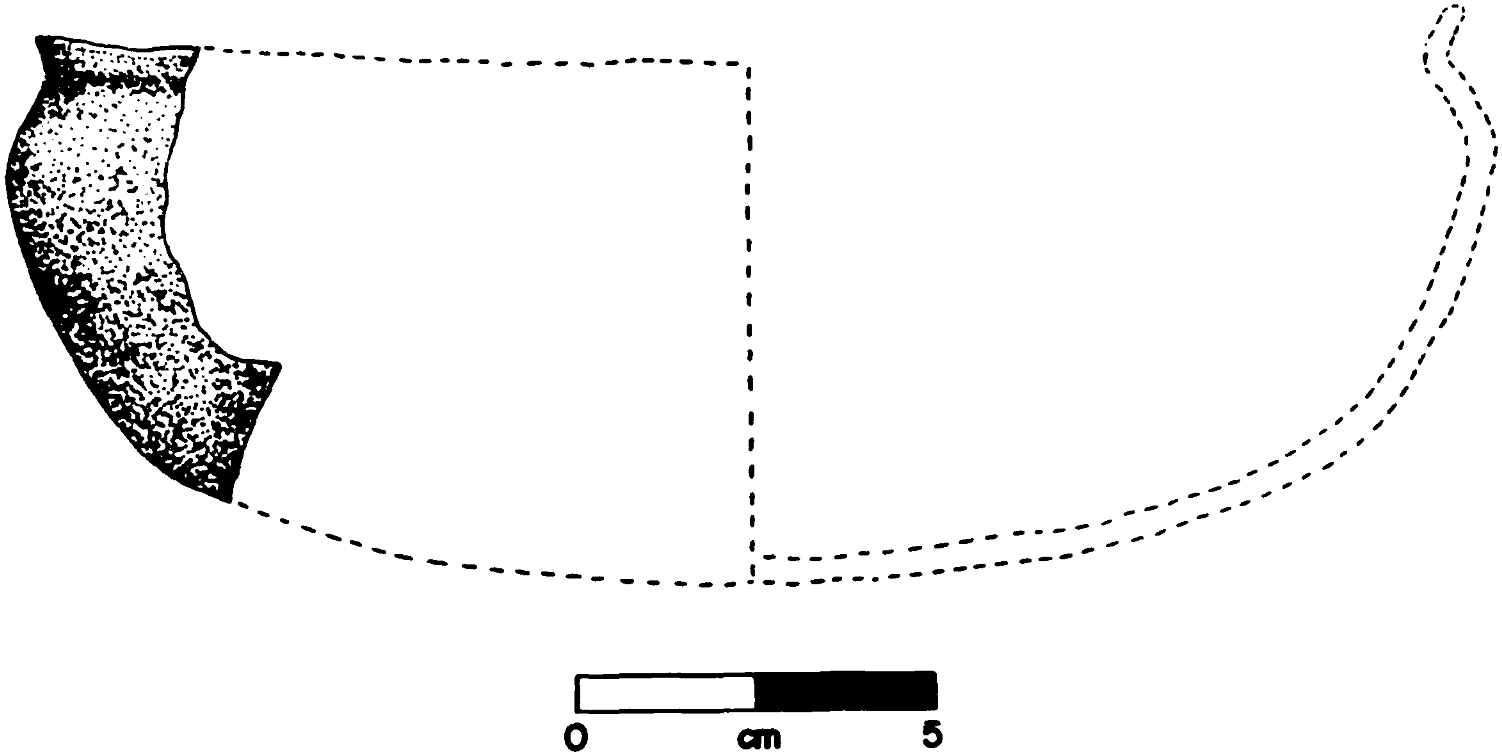


Figure 25. Mississippi Plain var. Warrior, simple bowl fragment.

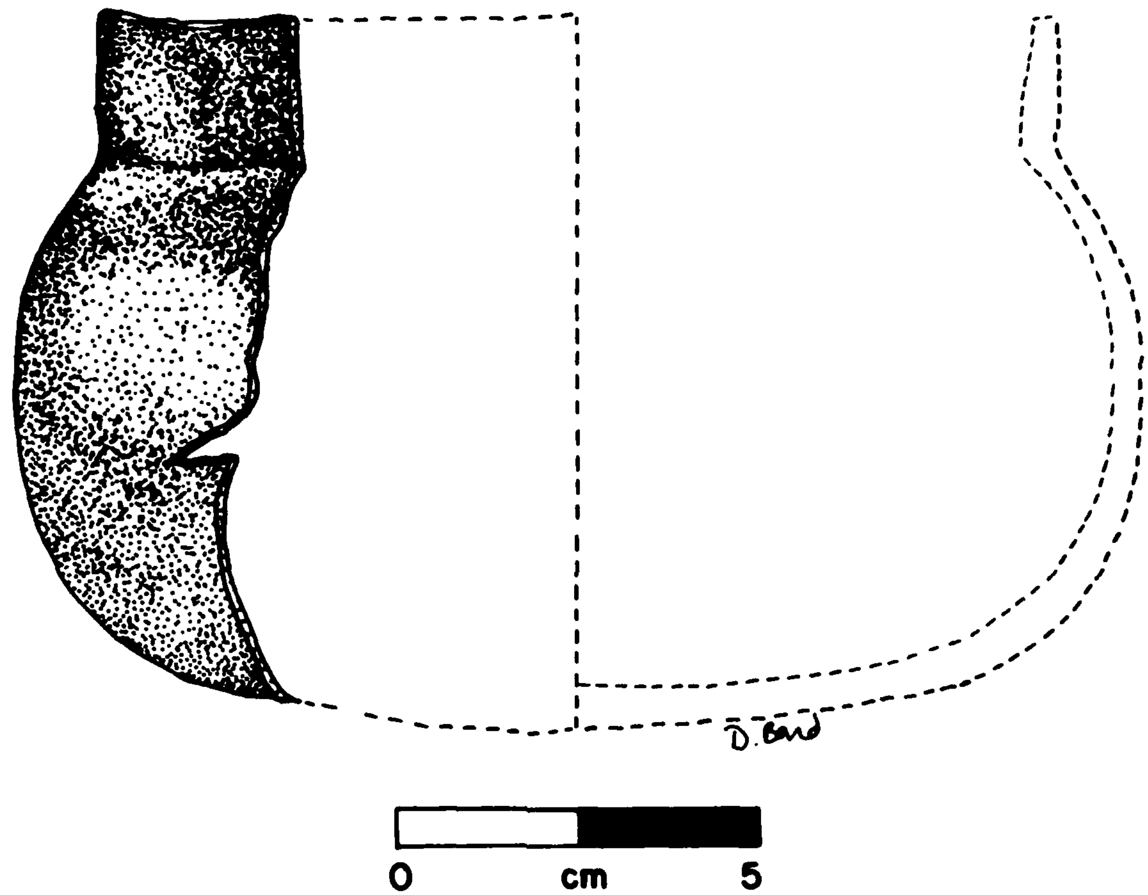


Figure 24. Mississippi Plain var. Warrior, short neck bowl.

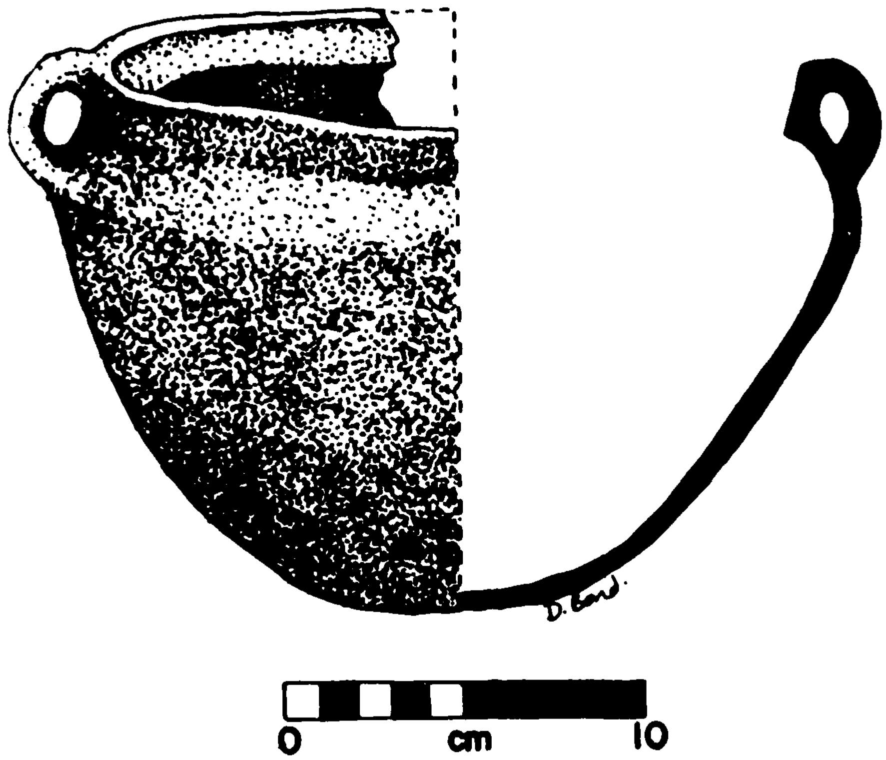


Figure 23. Mississippi Plain var. Warrior, short neck bowl.

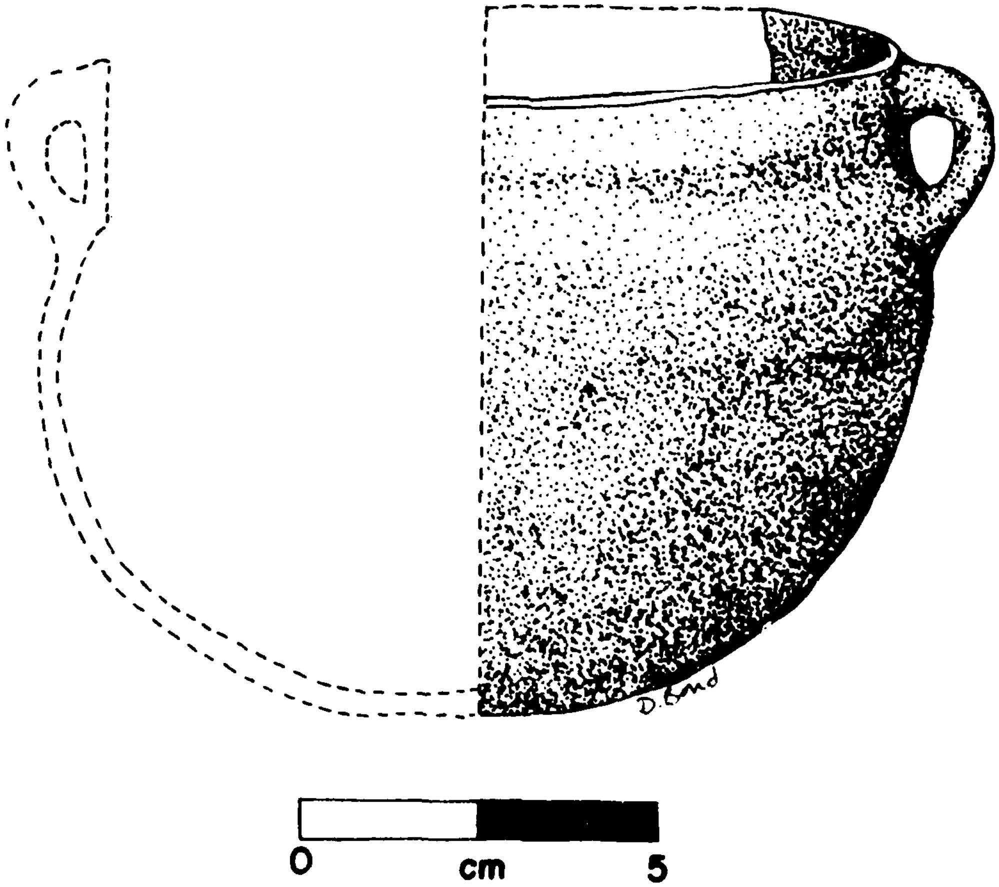


Figure 22. Mississippi Plain var. Warrior, short neck bowl form.

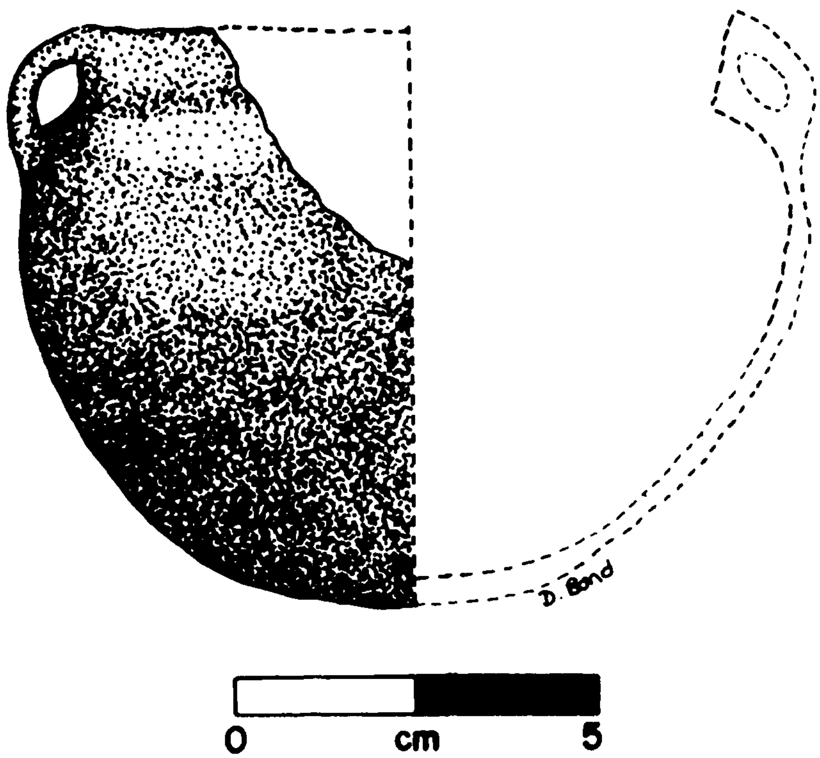


Figure 21. Mississippi Plain var. Warrior, short neck bowl form.

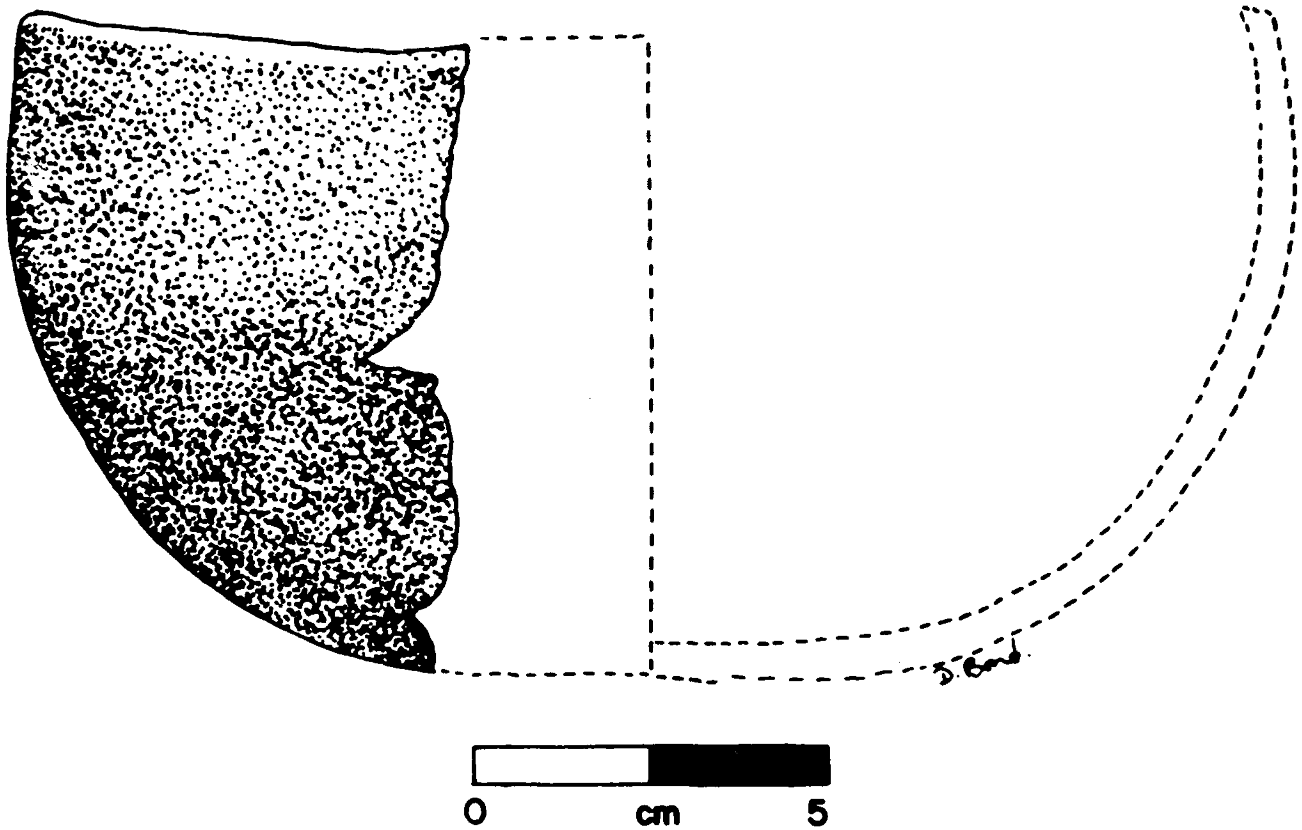


Figure 20. Mississippi Plain var. Warrior, simple bowl form.

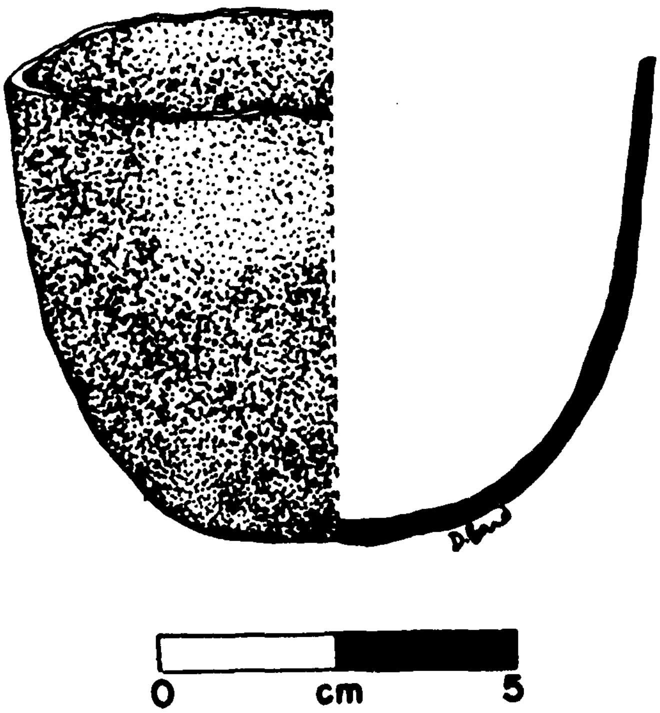


Figure 19. Mississippi Plain var. Warrior, simple bowl form.

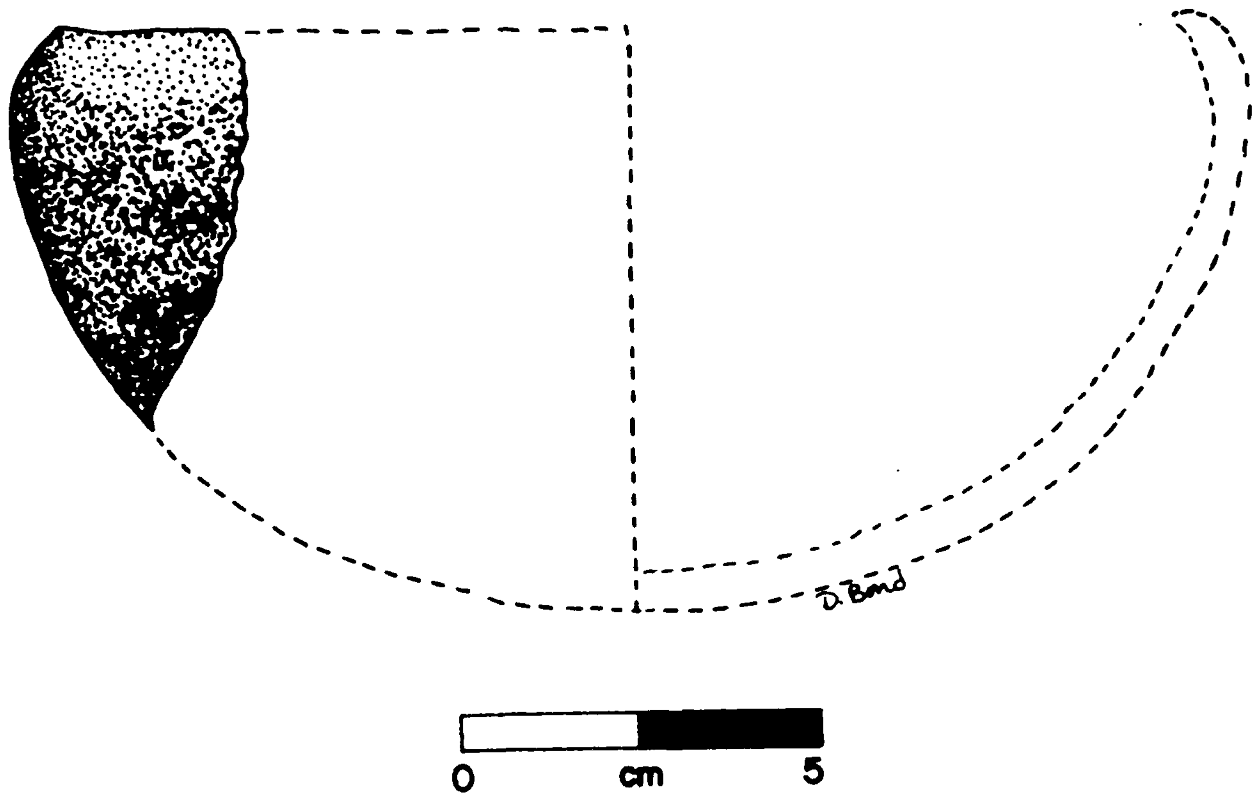


Figure 18. Mississippi Plain var. Warrior, simple bowl form.

attribute level must be completed.

Mississippi Plain var. Hull Lake: Steponaitis 1980:Figure 41p-q.

Comment

No examples of Mississippi Plain var. Hull Lake as described by Jenkins (1979a:74) or Steponaitis (1980:98) were recovered from the Lubbub Creek Archaeological Locality. There were some sherds which contained coarse shell temper with inclusions of occasional nodules of shell tempered clay, but these nodules would have been common in a ceramic workshop area because of vessel modification and decoration, and their addition to the paste of these sherds was probably not deliberate.

MOUND PLACE INCISED

Documentation: Phillips, Ford, and Griffin 1951; Phillips 1970; Jenkins 1979a.

Background

Since this type's conception (Phillips, Ford, and Griffin 1951:147) to the present day, there has been much comment and discussion as to whether or not it should be considered a type. Although Phillips (1970:135) described this type as "too rare and scattered to serve any useful purpose" in the Mississippi Valley area, Jenkins (1979a:85) stated that at the Mississippian sites surrounding Moundville "it occurs consistently although not in large numbers on sites occupied by the Moundville Culture." Because of this common occurrence, the type was used in this study.

The original type description was presented by Phillips, Ford, and Griffin, and their description was as follows:

> Two or more parallel lines are placed horizontally on the exterior rim. Occasionally, these lines dip down on each side of the vessel in concentric festoons. Sometimes these festoons occur beneath semi-circular lugs. This is quite typical for rim effigy vessels, in which such lines are festooned beneath the head and the lug which represents the tail of the bird or animal concerned (Phillips, Ford, and Griffin 1951:147).

Probable Relationships

This type is probably most closely related to the type Carthage Incised defined by Steponaitis (1978). Because of the similarity of the broad trailed incisions, Steponaitis (1980:95) placed the broad trailed var. Akron under Carthage Incised, but placed the thin line or engraved variety under Moundville Engraved var. Havana. Because of the importance of this design element, the author agrees with Jenkins in the type distinction given to vessels with this decoration.

Mound Place Incised var. Akron: Figure 29; Phillips 1970:Figure 59a-d; Phillips, Ford, and Griffin 1951:Figure 89t-w; Jenkins 1979a:Figure 4a,d; DeJarnette and Peebles 1970:111

Sorting Criteria and Attributes

Mound Place Incised var. Akron was distinguished from var. Havana on the basis of line width. To be classified as var. Akron the line width had to measure 1 mm or larger. The maximum line width was 4.5 mm. Mean line width was 2.18 mm (n=68; s=0.83 mm).

Mound Place Incised var. Akron was limited to one or another of the bowl forms in this study. Due to the very fragmented nature of the material, 53.7 percent of the 67 sherds were classified as from miscellaneous bowls. The next highest occurrence of vessel form was the cylindrical bowl, 23.9 percent. Simple bowl forms accounted for 19.4 percent, and restricted bowls for 3.0 percent of the sherds.

The lines on 95.5 percent of the 67 sherds were incised on a leather-hard paste, 3.0 percent were incised on a wet paste, and 1.5 percent were incised on a bone dry or fired paste.

Shell was the sole tempering agent in 75 percent of the sherds, and mixed shell and grog were used as temper in 25 percent of the sherds. The minimum temper size was 0.3 mm and the largest was 3.1 mm. The mean temper size was 1.21 mm (n=68; s=0.57 mm).

Only 36.7 percent of the sherds studied had been smudged or blackfilmed. Of the sherds which were smudged or blackfilmed, 85.2 percent exhibited this treatment on both the interior and exterior, 11.1 percent on the interior only, and 3.7 percent on the exterior only. The exterior surfaces of 77.6 percent of the 68 var. Akron sherds studied were burnished, and 22.4 percent were unburnished and smoothed. The interior surfaces of 74.6 percent were burnished, 23.9 percent were unburnished and smoothed, and 1.5 percent were unburnished and scraped.

Secondary shape features which occurred in this variety included rim modifications. Of the 60 rims examined, 1.7 percent were folded rims. 8.3 percent were folded flattened rims, 3.3 percent were beaded, and 1.7 percent were scalloped.

One occurrence of vessel wall indentation was observed. Of the material classified as var. Akron, 17.6 percent had vessel walls which were modified for the support of rim effigies. Only a single occurrence of part of an effigy configuration still attached to the vessel wall was noted. This effigy fragment was placed in the "other effigy" category because the fragment was insufficient for identification of the effigy form.

Comment

Mound Place Incised var. Akron is believed to make its earliest appearance during Late Moundville I and to increase in frequency through time. This variety should prove important in further chronological seriation of the Mississippian assemblages in Alabama as a larger data base is accumulated.

Mound Place Incised var. Havana: [illegible] 1979a:Fig. [illegible]

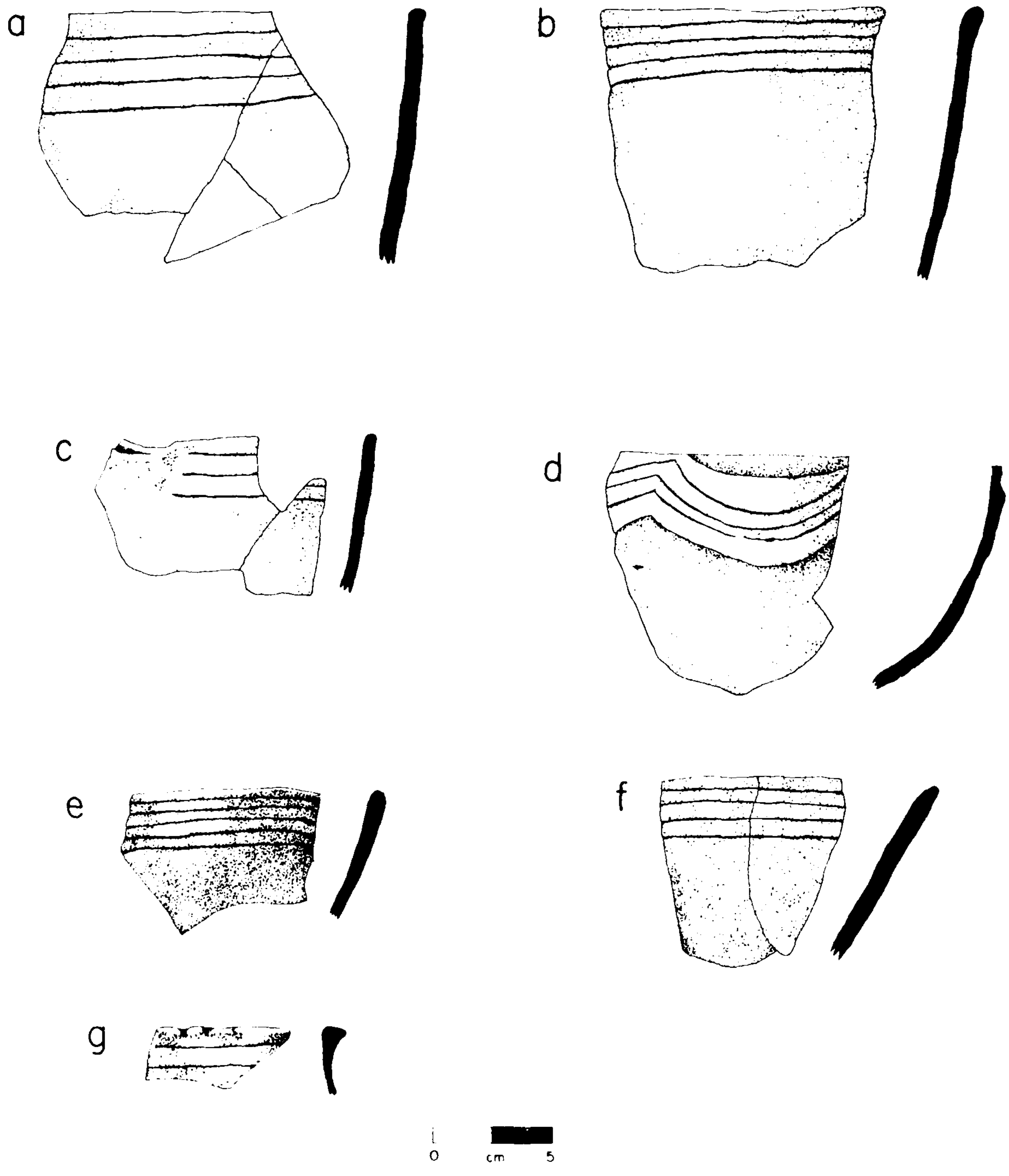


Figure 29. Mound Place Incised var. Akron.

Sorting Criteria and Attributes

The design elements of Mound Place Incised _var. Havana_ were the same as those of _var. Akron_, but the line width of _var. Havana_ was never larger than 1 mm. The minimum line width was 0.4 mm, and the maximum line width was 0.9 mm. The mean line width was 0.66 mm (n=14; s=0.17). Forty-two percent of the incisions were executed on a leather-hard paste, 42 percent on a bone dry paste, and 16 percent on a wet paste.

Of the 12 _var. Havana_ sherds for which shape could be determined, 45.5 percent were from simple bowl forms, and the remainder were from miscellaneous bowls. The temper of 76.9 percent of the sherds was shell, and 23.1 percent were tempered with mixed fine shell and grog. The minimum temper size was 0.4 mm and the maximum was 2.0 mm. The mean temper size was 0.89 mm (n=14; s=0.43 mm).

Mound Place Incised _var. Havana_ is one of the varieties which was, in the past, included under the types Moundville Film Incised and Moundville Filmed Engraved. When the ceramics of this variety were examined, 66.7 percent of the sample were smudged or blackfilmed. Deliberate surface coloration was noted on both the interior and exterior surfaces of 85.7 percent of these sherds, and one example (15.3 percent of the sample) was too eroded for this determination to be made. The exterior surfaces of 91.7 percent were burnished, 8.3 percent were unburnished and smoothed, and one example was too eroded to classify.

Only two secondary shape features were noted on sherds classified as Mound Place Incised _var. Havana_, both of which dealt with the rim area of the vessel. One example of a folded flattened rim was noted, and there was one example of a notched rim.

MOUNDVILLE ENGRAVED

Documentation: Willey 1949; Wimberly 1960; McKenzie 1964; Jenkins 1979a; Steponaitis 1980.

Background

The type Moundville Engraved and its varieties make up a small but important percentage of the Mississippian ceramic assemblages found at the Lubbub Creek Archaeological Locality. Steponaitis (1978; 1980) provided an important typology of the Moundville Engraved varieties based on design motifs. Of the eleven varieties, only Steponaitis' _var. Havana_ (1980:100) was not used in the classification of Moundville Engraved ceramics in this study. This variety is discussed under Mound Place Incised rather than Moundville Engraved. Of the ten other varieties, only four were found at the Lubbub Creek Archaeological Locality. These were _var. Hemphill_, _var. Wiggins_, _var. Taylorville_, and _var. Tuscaloosa_.

Because of the very fragmented nature of all the Moundville Engraved ceramics, only rarely were the vessel forms determinable. The Moundville Engraved varieties occurred only on bowl and bottle forms. The engraved lines which formed the design motifs of the Moundville Engraved varieties were predominantly very thin (less than 1 mm) and were executed on a bone dry or

fired paste. Rare exceptions were noted, but the Moundville Engraved wares are best described as finely engraved wares which had a surface which was either smudged or blackfilmed or burnished.

Probable Relationships

Jenkins (1979a:77) believes that "Moundville Engraved is most closely related to Walls Engraved *var. Walls* of the Southwestern Tennessee-Northeast Arkansas area (Phillips 1970:170)." The early engraved wares are probably closely related to Walls Engraved. But by the Summerville III period the Moundville site itself was serving as a major center of manufacture of this ceramic type and was probably responsible through trade for the occurrence of this type and its reproduction in both the Mobile Bay-Delta area (Wimberly 1960) and the Tombigbee drainage (Jenkins 1979a).

Moundville Engraved *var. Hemphill*: Figure 30d-h; Jenkins 1979a:Figure 6a-g.

Sorting Criteria and Attributes

Moundville Engraved *var. Hemphill* recovered from the Lubbub Creek Archaeological Locality is defined by engraved, free-standing representational motifs, which, as Jenkins points, out "pertains to the iconography of the Southeastern ceremonial complex" (Jenkins 1979a:78). The motifs recovered from the Lubbub Creek Archaeological Locality were death heads (Steponaitis 1980:Figure 20x), long bones (*ibid*.:Figure 20f), and other incomplete designs.

Because of the fragmented nature of the material recovered, only a single vessel form -- a bottle -- was recognized for this variety. The line widths of the motifs of *var. Hemphill* ranged from 0.4 mm to 1.0 mm. The mean line width was 0.71 mm (n=7; s=0.27 mm). Of the 7 sherds studied, 71.4 percent had incisions which were executed on a bone dry paste, and 28.6 percent were executed on a leather hard paste. Fine shell was the tempering agent in 42.9 percent of the sherds of *var. Hemphill*, and 57.1 percent were tempered with mixed shell and grog. The minimum temper size was 0.3 mm and the maximum was 1.3 mm. The mean temper size was 0.73 mm (n=7; s=0.40 mm).

Fifty-seven percent of the *var. Hemphill* sherds studied were smudged or blackfilmed. Of these sherds, 75 percent were smudged or blackfilmed on both the interior and exterior surfaces, and 25 percent on the exterior surface only. One hundred percent were burnished on the exterior surface. The interior surfaces of 71.4 percent were burnished, 14.3 percent were unburnished and smoothed, and 14.3 percent were unburnished and scraped. The Moundville Engraved *var. Hemphill* ceramics exhibited none of the secondary shape features selected for study in this report.

Comments

Because of the small sample designated as Moundville Engraved *var. Hemphill*, little can be said except that this variety was confined largely to the Summerville III period.

Moundville Engraved *var. Taylorville*: Steponaitis 1980:Figure 18j-k

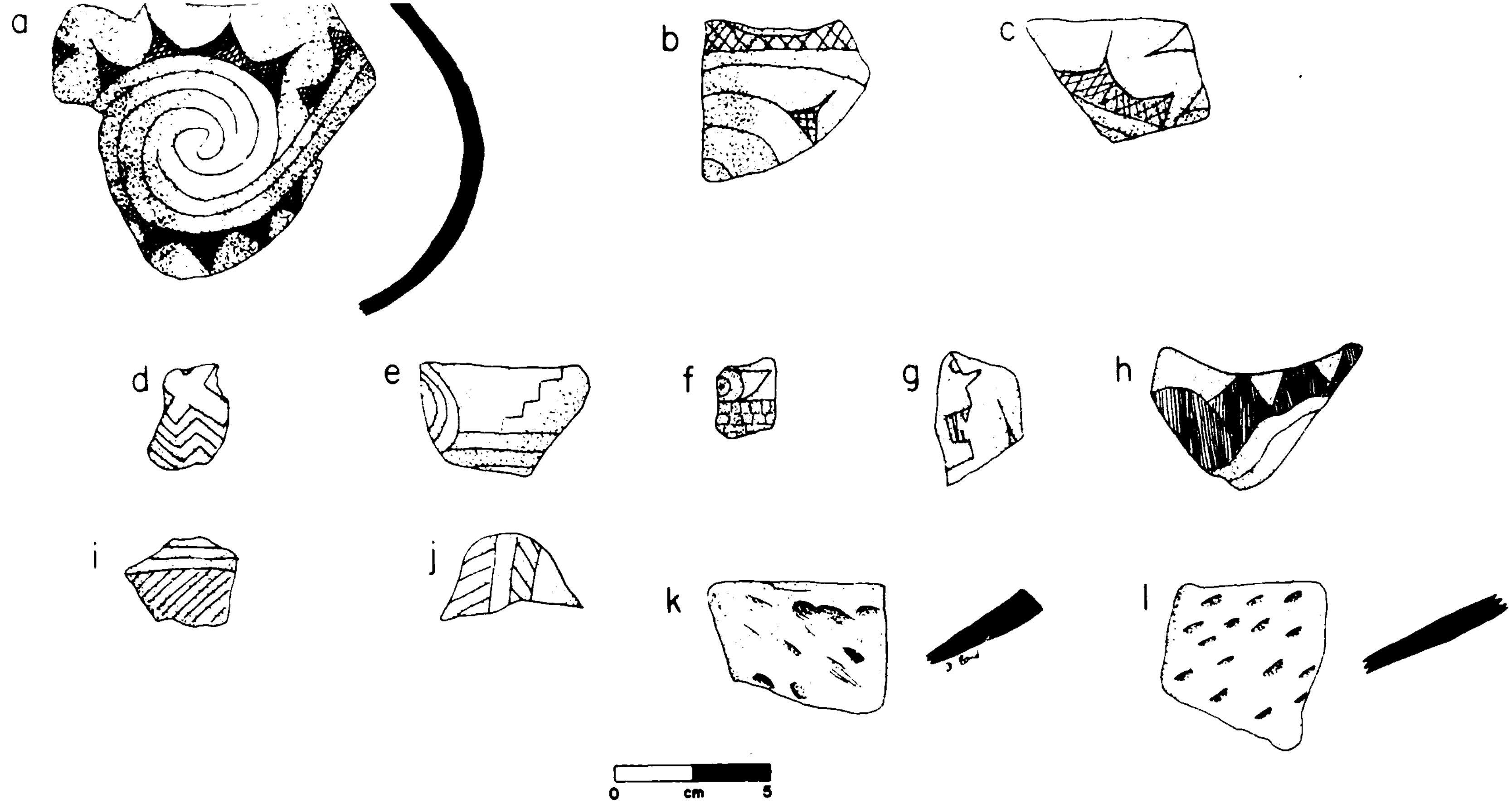


Figure 30. Moundville Engraved and Kimswick Fabric Impressed: a-c, Moundville Engraved var. Wiggins; d-h, Moundville Engraved var. Hemphill; i-j, Moundville Engraved var. Indeterminate (similar to var. Prince Plantation, but too small for positive identification); k-l, Kimswick Fabric Impressed var. Unspecified.

Sorting Criteria and Attributes

Moundville Engraved var. Taylorville is best described by Steponaitis (1980:101-102) as "a design made up of a 3-4 line running scroll superimposed on a cross hatched background...Vessels of this variety include subglobular bottles with simple, slab or pedestal bases, cylindrical bowls, and pedestalled bowls."

Because of the small, fragmented sherds of this variety, only three sherds could be identified as to vessel form, and each comprised fragments of bottles. The minimum line width of the design motif was 0.4 mm and the maximum 1.7 mm. The mean line width was 0.68 mm (n=25; s=0.32 mm). The engravings on 58.3 percent of the 24 sherds were executed on a bone dry paste, and 41.7 percent were engraved on a leather-hard paste. Shell was the tempering agent of 32 percent of the sherds, and 68 percent were tempered with mixed fine shell and grog. Temper size ranged from 0.3 mm to 1.4 mm. The mean temper size was 0.78 mm (n=25; s=0.24 mm).

Of the 25 var. Taylorville sherds studied, 68 percent were smudged or blackfilmed. The placement of this coloration was on the exterior only of 56.3 percent of these sherds, and on both the interior and exterior surfaces of 43.8 percent. The exterior surfaces of 80 percent of the sherds were burnished, and 20 percent were unburnished and smoothed. The interior surfaces of 48 percent were burnished, and 52 percent were unburnished and smoothed.

No examples of secondary shape features were noted for this variety.

Comment

Because of the small number of engraved wares of this variety recovered, and because all engraved varieties reached their highest numerical frequency in the Summerville III period, we have a limited understanding of these ceramics as viewed from the Lubbub Creek Archaeological Locality.

Moundville Engraved var. Tuscaloosa

Sorting Criteria and Attributes

This variety, as described by Steponaitis (1980:102),

> ...includes vessels decorated with a curvilinear scroll made up of 15-40 closely spaced lines (Figure 181). The scroll encircles the vessel and is wide enough to take up almost the entire design field. Vessels of this variety are always subglobular bottles with pedestal, slab, or simple bases, and are almost always embellished with indentations in the wall.

Of the material recovered from the Lubbub Creek Archaeological Locality, there were no examples large enough to determine vessel shape. The line width of the design motifs of var. Tuscaloosa varied from 0.4 mm to 1.2 mm. The mean line width was 0.73 mm (n=24; s=0.21 mm). Of the 24 sherds studied, 54.2 percent were engraved while the paste was in a bone dry or fired state, and the remaining 45.8 percent were applied while the surface was still in a

ther hard state. The paste of 45.8 percent of the 24 var. Tuscaloosa rds was tempered with fine shell, and the remaining 54.2 percent were pered with mixed fine shell and grog. Of the sherds studied, 45.8 had a dged or blackfilmed appearance. Of these sherds, 72.7 percent were smudged y on the exterior, and 27.3 percent were smudged on both the exterior and erior surfaces. The exterior surfaces of 87.5 percent of the sherds were nished, and 12.5 percent were unburnished and smoothed. The interior faces of 37.5 percent were burnished, and 62.5 percent were unburnished and othed.

A single pedestal base fragment was the only evidence of base shape for s variety. Also, indentations were noted on 37.5 percent (n=9) of the body rds studied.

ment

Moundville Engraved var. Tuscaloosa is one of the varieties which ibits the fine craftsmanship often observed at the Moundville site. ause of the fragmentary nature of this material, actual comparison of it h complete vessels from Moundville seemed futile. Such studies as trace ment analysis may possibly provide data which may prove the existence of a amic trade network between Moundville and other areas, including the Lubbub ek Archaeological Locality.

ndville Engraved var. Wiggins: Figure 30a-c; Jenkins 1979a:Figure 6h-i; ponaitis 1980:Figure 18m-p.

ting Criteria and Attributes

Moundville Engraved var. Wiggins, as described by Steponaitis (1980:102),

> ...is characterized by a design consisting of a 2-5 line scroll encircling the vessel's circumference. Occasionally, the scroll is embellished with fill-in crosshatching or with crosshatched triangular projections. The vessel form most commonly in this variety is the subglobular bottle with simple base.

the var. Wiggins sherds studied from the Lubbub Creek Archaeological ality, all examples had triangular projections which were either sshatched or non-crosshatched-filled. For this variety, only four bottle gments (7.1 percent) and one miscellaneous bowl fragment (1.7 percent) were ntified. The remaining 91.2 percent of the 51 sherds could not be ntified as to vessel form.

The line widths of the design motif of var. Wiggins ranged from 0.5 mm to) mm. The mean line width for this variety was 0.79 mm (n=55; s=0.26 mm). design motif was applied to a leather hard paste on 61.8 percent of the rds and to a bone dry or fired surface on 38.2 percent of the sherds. The nper of 26.8 percent of these ceramics was fine shell, and 73.2 percent were npered with mixed fine shell and grog. The minimum temper size was 0.3 mm l the maximum was 1.1 mm. The mean temper size was 0.65 mm (n=55; s=0.21 .

Of the sample of 55 sherds studied, 57.1 percent were smudged or

blackfilmed. Of these sherds, 59.4 percent had this deliberate surface coloration on the exterior surface only, and 40.6 percent were smudged or blackfilmed on both their interior and exterior surfaces. The exterior surfaces of 76.4 percent were burnished, and 23.6 percent were unburnished and smoothed. This proportion differed significantly from the interior surfaces, of which only 29.1 percent were burnished, 61.8 percent were unburnished and smoothed, and 9.1 percent were unburnished and scraped.

Only a single pedestal base was found in the ceramics classified as var. Wiggins. The extremely fragmented nature of these ceramics probably has a great deal to do with the lack of more secondary features noted for this variety.

Comments

No complete vessels of var. Wiggins have been recovered from the Gainesville Lake area. Only an analysis which allows for the recognition of specific attributes in a fragmented collection will allow the maximum amount of data to be recovered. The attributes of the var. Wiggins ceramics from the Lubbub Creek Archaeological Locality fit within the variety description (Steponaitis 1978).

Moundville Engraved var. Indeterminate

This category was established to note the existence of engraved sherds which did not meet the criteria for inclusion in the other Moundville Engraved varieties. All examples placed in this category were too small for identification of variety. Some of these sherds resembled Steponaitis' (1980:101) Moundville Engraved var. Prince Plantation (Figure 30i-j), but because of sherd size, positive identification could not be made.

MOUNDVILLE INCISED

Documentation: DeJarnette and Wimberly 1941; Heimlich 1952; Wimberly 1960; McKenzie 1964, 1965, 1966; Steponaitis 1978, 1980; Jenkins 1979a.

Background

This type appears to be one of the few decorated types in the Mississippian ceramic assemblages which have a temporal continuum equal to the entire Mississippian period. Because this type was represented in each of the Summerville periods, changes in numerical dominance of the different varieties of this type through time proved useful in establishing the chronological sequence for the Mississippian ceramic assemblages (see Chapter 2, Volume I).

The type was first described by DeJarnette and Wimberly (1941) at the Bessemer site, and later it was noted in the ceramic assemblages of the central Tennessee valley (Heimlich 1952) and the Mobile Bay-Delta area (Wimberly 1960). Moundville Incised was first described at the site of Moundville proper by McKenzie (1964, 1965, 1966). Phillips (1970:128) described ceramics in the Mississippi valley with the same arch motif which is the primary design element for Moundville Incised as Matthews Incised var. Manley. Jenkins (1979a:102) described the state of perplexity this caused him, Coblentz, and Steponaitis when they were deciding which type name

ropriate for the description of the Moundville and Lubbub Creek s. Because of the great variation in this material in the local assemblages and the early description of the type Moundville Incised, ype name took precedence over the later ·r·· · ·atthews Incised, and lle Incised was decided to be the proper type-name for these ceramics area.

e Moundville Incised ceramics are a group which have a common design in their motifs. This primary design element is an arch motif placed, onaitis (1980:102) said, "end-to-end around the upper portions of the " Three major variations of this design were noted and given variety When the arches were unadorned with any secondary design element, the as placed in var. Carrollton. When thin straight lines were applied icular to the arches in the area between the arch and the neck or rim vessel, the sherd was placed in var. Moundville. When the rays of loundville were replaced with punctations, the sherd was placed in iows Bend. In each of these varieties, the arch was an incised line.

o other variations of the design element were noted in this study. The as an arch motif which was composed completely of punctations. This on was noted as Moundville Incised var. Other throughout the analysis. ond variation was an excised line which was formed by the thinning of dy wall by the removal of clay below the arch. Usually, the arch was ncised on the body wall, then the lower body wall surface was carved leaving only one side of the incision trough, the side closest to the his arch design occurred primarily with punctations as a secondary element, so the excised line was noted and sherds of this nature were in var. Snows Bend.

undville Incised ceramics were tempered with coarse shell. The vessel n which the motifs occurred were usually jars or short neck bowls.

e chronological positions of the Moundville Incised varieties were ed by the seriation. Variety Moundville was common in the Summerville d, but declined rapidly in Summerville II. Also found in Summerville I . Snows Bend, but in very low frequency. In the Summerville II period, arrollton was dominant. This variety was found in each of the ille periods, but at low frequencies in Summerville I and III. It was the latter part of the Summerville III period that the variation of arches and punctations occurred. It appears that toward the end of ille III, the excised arch replaced the incised arch in var. Snows At some point, possibly terminal Summerville III, the excised arch was from the design, and the secondary design element, the punctations the primary design element. The arches were then composed of ions without incised or excised lines present. This can probably be s a marker for terminal Summerville III. Sherds which could be ied as Moundville Incised but whose variety could not be determined aced in Moundville Incised var. Indeterminate.

lle Incised var. Carrollton: Figure 31, 32, 33; DeJarnette and ly 1941:Figure 73, bottom center; Jenkins 1979a:Figure 5a-f; Steponaitis igure 19a.

Sorting Criteria and Attributes

Moundville Incised var. Carrollton was by far the most abundant variety of the three described. As noted above, var. Carrollton exhibited incised arches which were unadorned with any secondary design elements. When the sherds assigned to this variety were examined for vessel form, 40 of 140 could be classified as to shape, and the results were as follows: 42.5 percent were standard jar fragments (Figure 31), 42.5 percent were miscellaneous jar fragments, 12.5 percent were short neck bowl fragments, and 2.5 percent were restricted bowl fragments.

The width of the incised line ranged from 0.3 mm to 11.2 mm. Despite the great variation in line width, the mean line width was 1.90 mm (n=133; s=1.44 mm). The incisions were made on a wet paste on 58 percent of the 131 sherds, and 42 percent were incised on a leather hard paste.

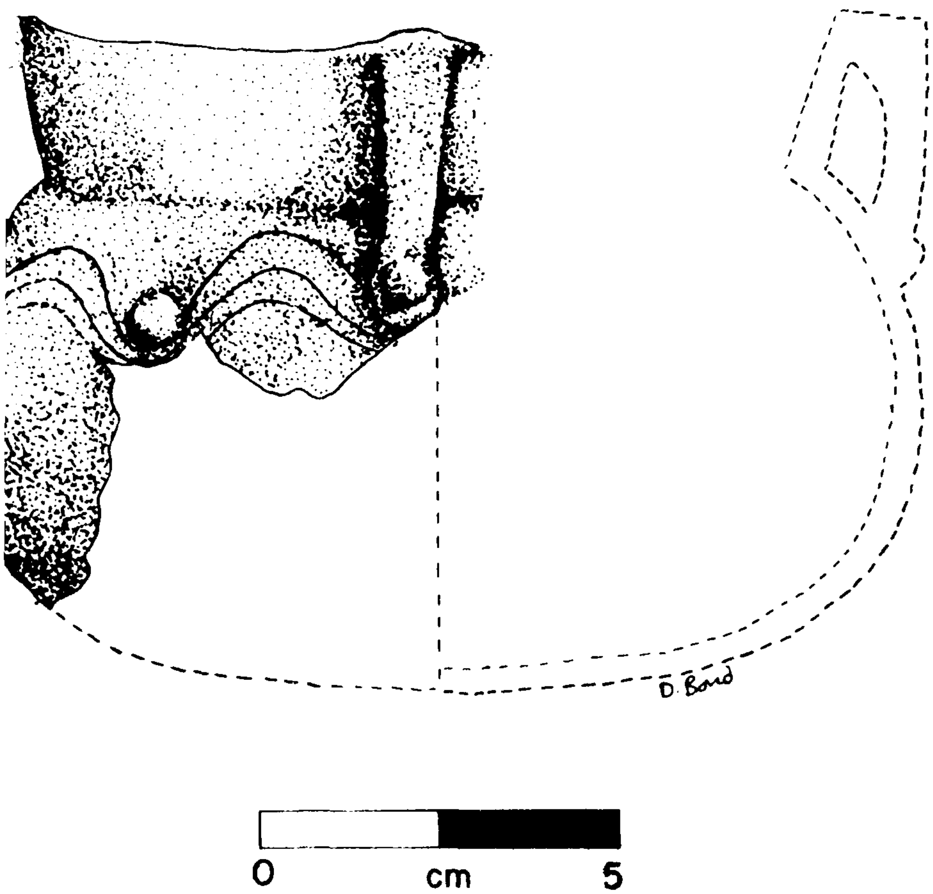
In this variety, there was a great deal of variation in temper size, from 0.2 mm to 5.0 mm. The mean temper size was 2.25 mm (n=140; s=0.66 mm). Only one example of deliberate surface coloration was noted. This was a heavily smudged interior which probably was not intentionally smudged, but rather was a by-product of the vessel's function. The exterior surfaces of 97.1 percent of 140 sherds were unburnished and smoothed. Four (2.9 percent) rare examples of burnishing on the exterior surface were noted for this variety. The interior surfaces of 95.6 percent were unburnished and smoothed, 2.9 percent were unburnished and scraped, and 1.5 percent were burnished.

The only rim or body modification noted for this variety was a single occurrence of a folded flattened rim. Eighteen handles were assigned to var. Carrollton, and variation in handle metrics will probably play an important role in the seriation of this variety. The handles from the Lubbub Creek Archaeological Locality followed the same general changes through time as noted for the Moundville site by Steponaitis (1980). Variety Carrollton handles found in association with late Summerville I features were rather round in cross-section and were considered to be loop handles. In Summerville II features, the handles were more strap-like, with the top of the handle slightly wider than the bottom. In Summerville III, the handles were triangular in shape and flat or rectangular in cross-section. The method of handle attachment also varied through time. In late Summerville I and early Summerville II, the handles were riveted to the vessel wall. By late Summerville II and early Summerville III, the handles were riveted at the bottom and luted at the top. By late Summerville III, the largest number of handles were luted at both the top and the bottom. Some were still riveted at the bottom, but they were in the minority by middle to late Summerville III.

Comments

Although this variety has caused much confusion in the seriation of Mississippian ceramics, it promises to be one of a number of valuable keys to understanding the Mississippian assemblages of central Alabama. The lengthy temporal span and internal variation of this variety is one of the most complex and least understood.

Moundville Incised var. Moundville: Figure 34a-e; McKenzie 1966:Figure 2; Jenkins 1979a:Figure 4g-k; Steponaitis 1980:Figure 19b.



. Moundville Incised var. Carrollton, standard jar with nodes on shoulder.

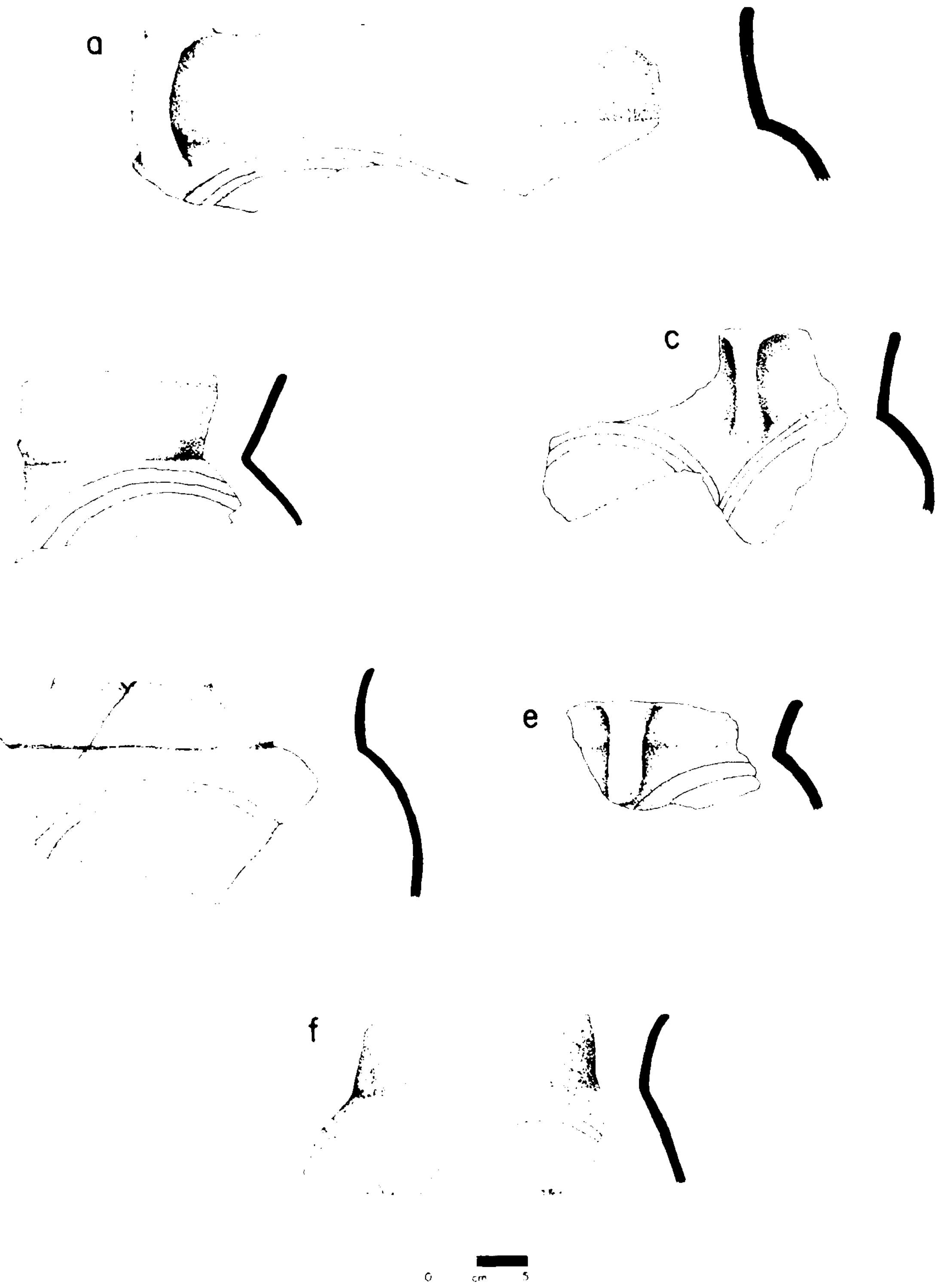


Figure 32. Moundville Incised var. Carrollton, a-f, standard jar fragments.

Figure 33. Moundville Incised var. Carrollton, a-d, standard jar fragments.

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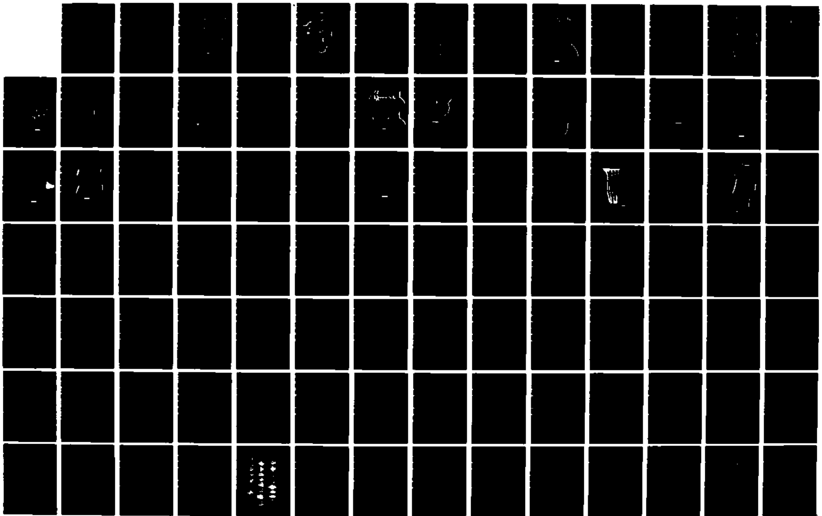
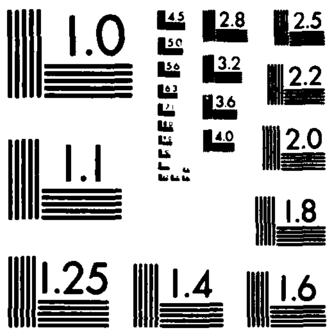




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Sorting Criteria and Attributes

Jenkins (1979a:82) stated that the decoration of Moundville Incised var. Moundville is the "same as Moundville Incised var. Carrollton except that the arch is embellished with a series of short incisions radiating upward from the arch."

Of the vessel forms identified for this variety, jar forms accounted for over 75 percent. Of the 17 sherds which could be assigned to a vessel shape, 35.3 percent were from miscellaneous jars, 41.2 percent were from standard jars, and 23.5 percent were from short neck bowls. The short neck bowl vessel form appears to play an important role in the early Mississippian assemblage. Close attention should be paid to this vessel form in future research.

The minimum line width of the arch, or primary design motif, of this variety was 0.6 mm and the maximum was 11.6 mm. The mean line width for var. Moundville was 3.08 mm (n=51; s=2.26 mm).

All sherds of this variety were shell tempered; there were no inclusions of grog noted. Temper size ranged from 1.0 mm to 3.9 mm. Mean temper size was 2.18 mm (n=66; s=0.51 mm).

When incised, the paste of 72.7 percent of the 66 sherds was wet, and 27.3 percent had a leather hard paste. No examples of deliberate surface coloration were noted. The exterior surfaces of 94 percent were unburnished and smoothed, and the remaining 6 percent were unburnished. The interior surfaces of 98.5 percent were unburnished and smoothed, and 1.5 percent were burnished.

A single variation was noted in the application of the incised lines which formed the "rays" of the design. In a single case, the rays appeared to have been applied in a hemiconical fashion.

Comment

Moundville Incised var. Moundville has proven to be one of the best markers for the early part of the Mississippian component at the Lubbub Creek Archaeological Locality. It dropped rapidly in frequency and occurs rarely if at all in Summerville II and Summerville III. It is therefore an ideal marker for the Summerville I period.

Moundville Incised var. Snows Bend: Figure 35c-d; Jenkins 1979a:Figure 6j-l; Steponaitis 1980:Figure 19c.

Sorting Criteria and Attributes

The design motif of var. Snows Bend consists of incised arches with arches of punctations above the incised lines. Of the sherds assigned to this variety, only four could be identified as to vessel form. Of those identified, 50 percent were standard jar fragments, 25 percent were simple bowl fragments, and 25 percent were miscellaneous bowl fragments.

The width of the incised line of the design motif varied from 1.4 mm to 5.3 mm. The mean line width was 2.66 mm (n=15; s=1.19 mm). Sixty-eight

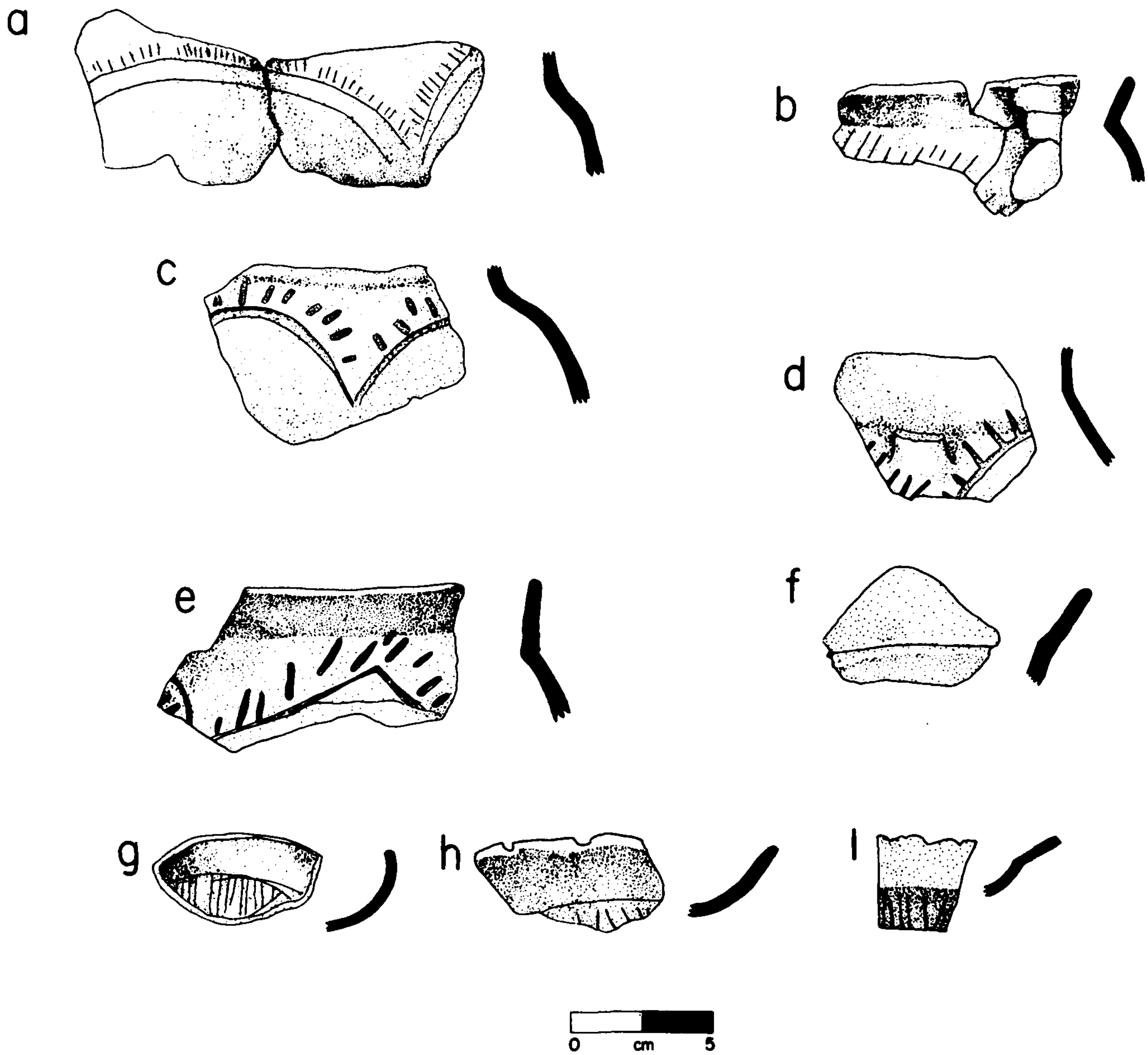


Figure 34. Moundville Incised and Unclassified Interior Incised: a-e, Moundville Incised _var._ _Moundville_; f-i, Unclassified Interior Incised.

percent of the incisions were executed on a wet paste, and 32 percent on a leather hard paste.

All Moundville Incised var. Snows Bend sherds were tempered with crushed shell, and no grog inclusions were noted. The temper size ranged from 0.5 mm to 3.5 mm. The mean temper size was 2.23 mm (n=26; s=0.60 mm).

A single example of a smudged or blackfilmed exterior was noted. In the sample of 26 sherds, the exterior surfaces of 92.3 percent of the sherds were unburnished and smoothed, and the remaining 7.7 percent were burnished. The interior surfaces of 92.3 percent of the sherds were unburnished and smoothed, 3.8 percent were burnished, and 3.8 percent were unburnished and scraped.

The only secondary shape attributes noted for this variety were four variations in the punctations above the incised arch. The most common punctation (56 percent) was described as "round" -- a straight-sided punctation with a flat bottom (Figure 36a-d). The next most common punctation was the "round with raised center" punctation (28 percent). This type of punctation appeared to have been applied with a hollow piece of cane and was a circular punctation whose interior surface retained its original surface height in some instances, but usually was depressed to some degree. A third type of punctation was the hemiconical punctation (12 percent). There was discussion as to whether sherds which exhibited this type of punctation should be placed in var. Snows Bend or var. Moundville. The hemiconical punctation can be considered an incision because the tool used to make this punctation was moved upward on the vessel's surface from the arched incision. The author first classified the sherds with hemiconical punctations as var. Snows Bend because it appeared that the same tool was used to make the "round" punctations of var. Snows Bend and the hemiconical punctations. Later in the analysis, these sherds were placed in Moundville Incised var. Unspecified. In one case, instead of the usual single row of punctations above the arch, the entire shoulder area above the arch was filled with this type of punctations. The last variation in punctation was a single occurrence of pinched punctations above the incised arch.

Comment

Moundville Incised var. Snows Bend was thought to occur in the late Mississippian period at the Lubbub Creek Archaeological Locality. This belief was probably related to the close similarity of this variety to Matthews Incised var. Manly (Phillips 1970:128), which Phillips noted as having a "Late Mississippian period" chronological position. At the Lubbub Creek Archaeological Locality, Moundville Incised var. Snows Bend made an early appearance as a late Summerville I minority ware. Rare examples of var. Snows Bend were noted in Summerville II context, and the variety began to gain in popularity again in Summerville III. However, a variation in the design element took place. The arch which was formed by an incised line during Summerville I and II was either replaced with an excised arch, or the arch was formed by punctations and the excised or incised arch was dropped from the motif altogether. Put simply, the secondary design elements (the punctations) took the place of the primary design element (the incised arch), and the primary design element was dropped from the motif. The material with motifs formed by punctated arches and excised arches was removed from the var. Snows Bend and was classified as Moundville Incised var. Unspecified until further

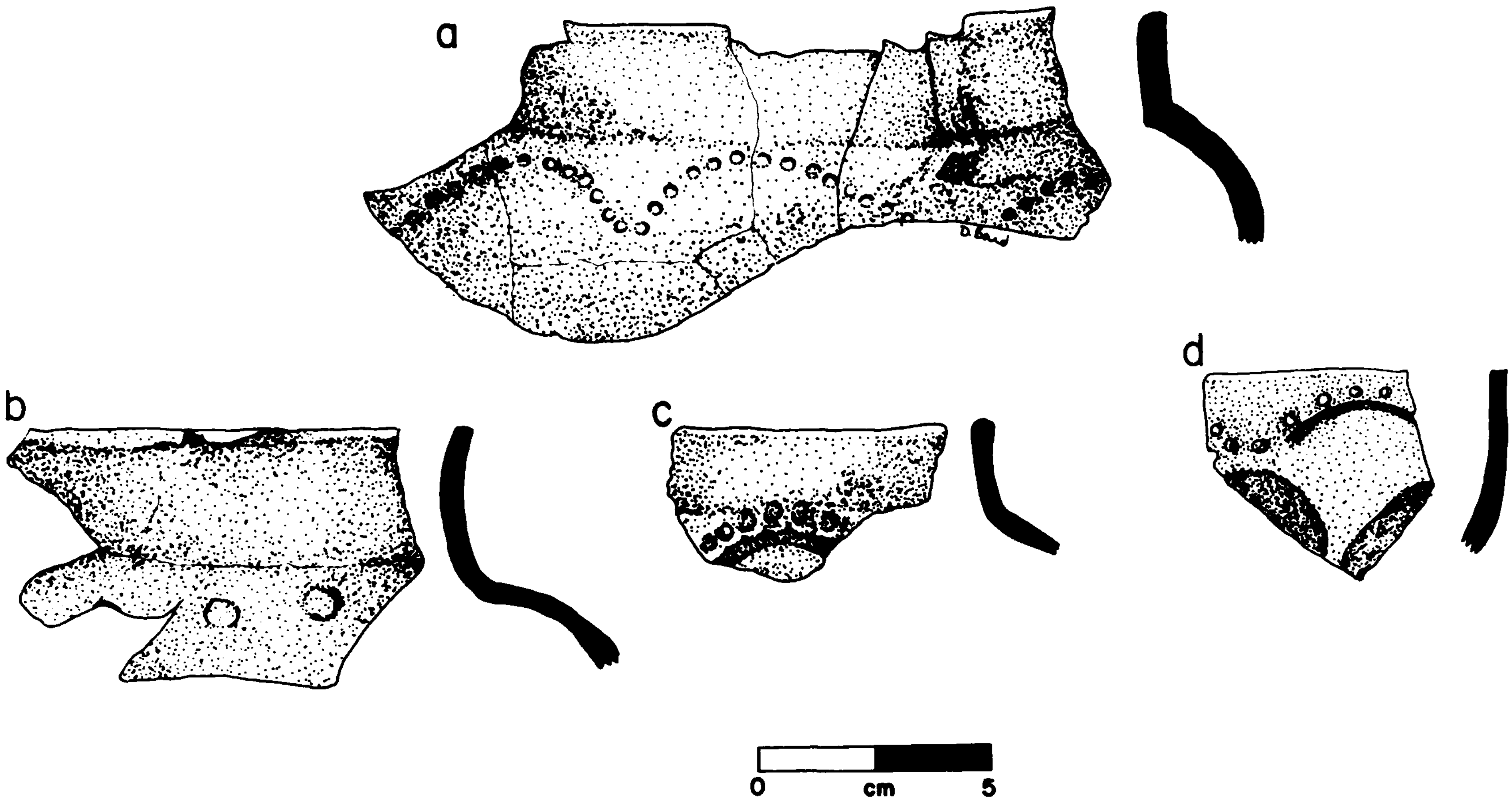


Figure 35. Moundville Incised: a-b, Moundville Incised var. Unspecified; c-d, Moundville Incised var. Snows Bend.

research corroborates this data and a variety name is determined.

Moundville Incised var. Unspecified: Figure 35a-b; Figure 36a-d.

Sorting Criteria and Attributes

The material classified in this study as Moundville Incised var. Unspecified was included under Moundville Incised var. Snows Bend in earlier research (Jenkins 1979a). This late variety of Moundville Incised had three variations in design motif: 1) circular punctations which formed arches with no incised arch present, 2) an excised arch with circular or hemiconical punctations above the arch, and 3) hemiconical punctations above an incised arch.

Only 43 percent of the material within this variety could be identified as to vessel form. Of the 13 sherds which could be identified, 53.8 percent were miscellaneous jar fragments and 46.2 percent were standard jar fragments.

In the single case where an incised line was present with hemiconical punctations, the line width measured 2.9 mm. Of 27 sherds, 87 percent of the punctations were executed on a wet paste and 13 percent on a leather hard paste. All sherds were shell tempered, and no inclusions of grog were noted. Temper size ranged from 1.2 mm to 2.8 mm. The mean temper size was 2.07 mm (n=30; s=0.45 mm). Only one example of possible deliberate surface coloration was noted. The interior surface of a bowl fragment may have been smudged or blackfilmed. This sherd was also burnished, but all other sherds were unburnished and smoothed.

Handles were the only secondary feature noted for this variety. All were triangular in shape and flat in cross-section.

Comment

Although a limited sample of this variety was recovered from the Lubbub Creek Archaeological Locality, the attribute analysis helped to distinguish between these sherds and those of var. Snows Bend. When further research is completed, the Moundville Incised var. Unspecified material will surely receive a new variety name, perhaps Moundville Punctated.

PARKIN PUNCTATED

Documentation: Phillips, Ford, and Griffin 1951; Phillips 1970; Jenkins 1979a.

Background

When Phillips, Ford, and Griffin (1951) first defined the type Parkin Punctated for the Mississippi Valley, they described the ceramics of this type as coarse shell tempered with punctations applied to the surface of the vessel. A great deal of variation was noted in punctation size and shape and also in the placement of the punctations. They usually were placed randomly over the vessel's surface, but were sometimes applied in rows. Two sherds of Parkin Punctated were reported by Nielsen and Jenkins (1973) from Site 1Pi7, less than one mile upriver from the Lubbub Creek Archaeological Locality.

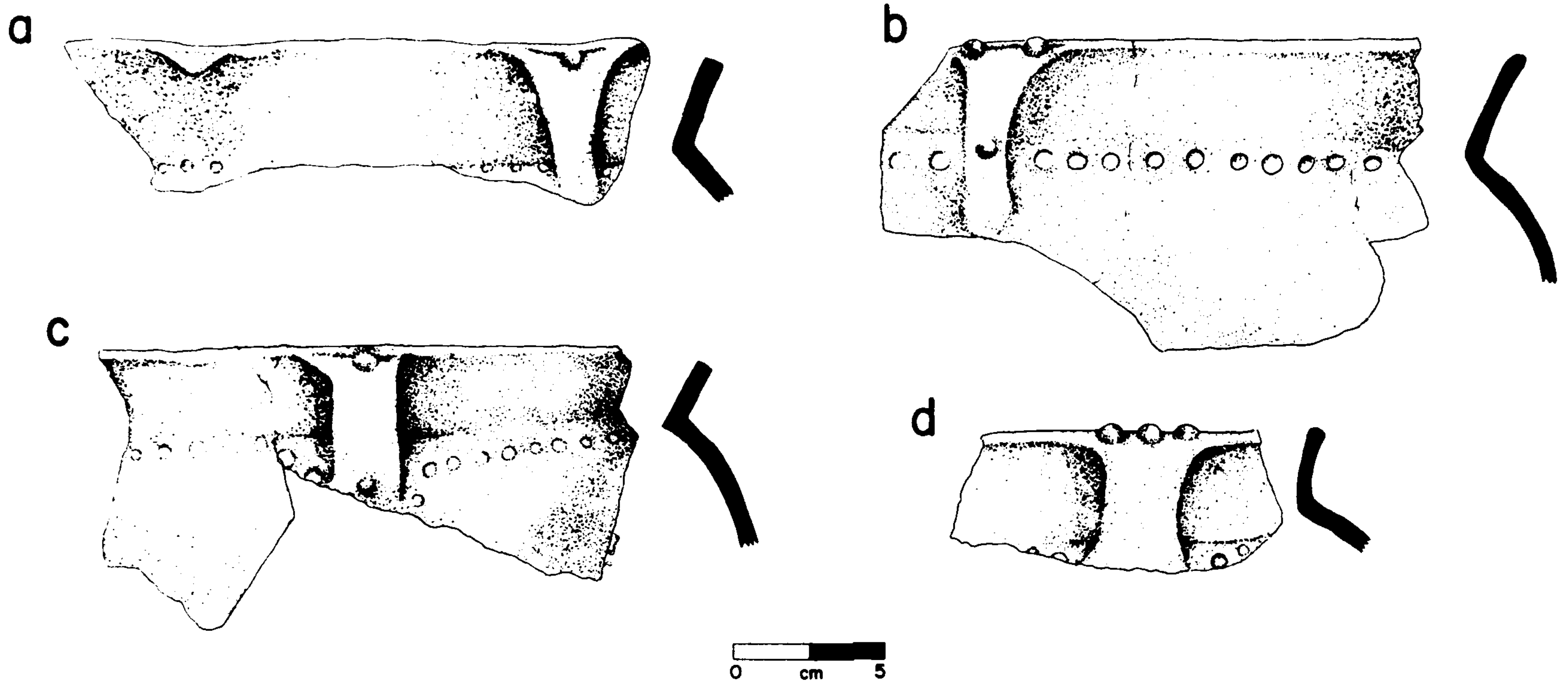


Figure 36. Moundville Incised var. Unspecified, standard jar fragments.

These sherds had random fingernail punctations, but the sherds were not large enough to determine vessel form. Jenkins (1979a:89) classified the ceramics with random fingernail punctations as a provisional variety, Parkin Punctated _var. Bridgeville_.

Sorting Criteria and Attributes

During excavations at the Lubbub Creek Archaeological Locality, 34 examples of Parkin Punctated were recovered. These sherds were not classified on the variety level, but were noted as Parkin Punctated _var. Unspecified_. The aligned punctations were the dominant punctation configuration. Two large vessel fragments were recovered, and both were from short neck bowls. One vessel fragment was fingernail punctated in uniform rows (Figure 37a) which covered the entire exterior surface. This vessel fragment had an attached handle which was also fingernail punctated and had a single node applied at the point where the handle intersected the rim. The second large vessel fragment (Figure 37b) was decorated with free standing groups of punctations placed at intervals on the vessel's shoulder. The remaining 32 sherds of Parkin Punctated were too small to determine vessel shape.

Measurements of punctation width were taken from one side of the crescent to the other. The minimum width was 6.5 mm and the maximum, 11.9 mm. The mean punctate width was 9.19 mm (n=34; s=1.44 mm). A measurement was also taken of the distance from the point where the displacement of clay began to the point where it ended, measured at the center of the crescent. Minimum displacement was 1.0 mm and the maximum was 7.8 mm. The mean pinch displacement was 3.40 mm (n=34; s=2.07 mm). No incidences of deliberate surface coloration were noted. All of the exterior surfaces were unburnished and smoothed, 94.1 percent of the interior surfaces were unburnished and smoothed, and 5.9 percent were unburnished and scraped.

The single handle already described for this type was the only secondary feature noted. This was a parallel sided handle; such handles appear commonly in the early Mississippian assemblages.

Comment

Because of the limited amount of Parkin Punctated recovered from the Lubbub Creek Archaeological Locality, its chronological position could not be determined by the seriation. Ceramics of this type were usually recovered in extremely mixed areas of the site, and no sherds of this type were from features which were radiocarbon dated. For now, Parkin Punctated ceramics can only be assigned to the Mississippian period.

OTHER VARIETIES

This category includes the Alabama River phase burial urns and a single red painted burial urn cover. The burial urns themselves, with their triangular handles, would be indistinguishable from Mississippi Plain _var. Warrior_ if they were reduced to sherds. The burial urn cover placed in this category had a red painted design on its interior surface (Figure 38) which was similar to other painted burial urn cover designs from the Warrior drainage. It seemed advisable to place these plain Alabama River phase burial urns and the painted urn cover in a general category until a consensus is

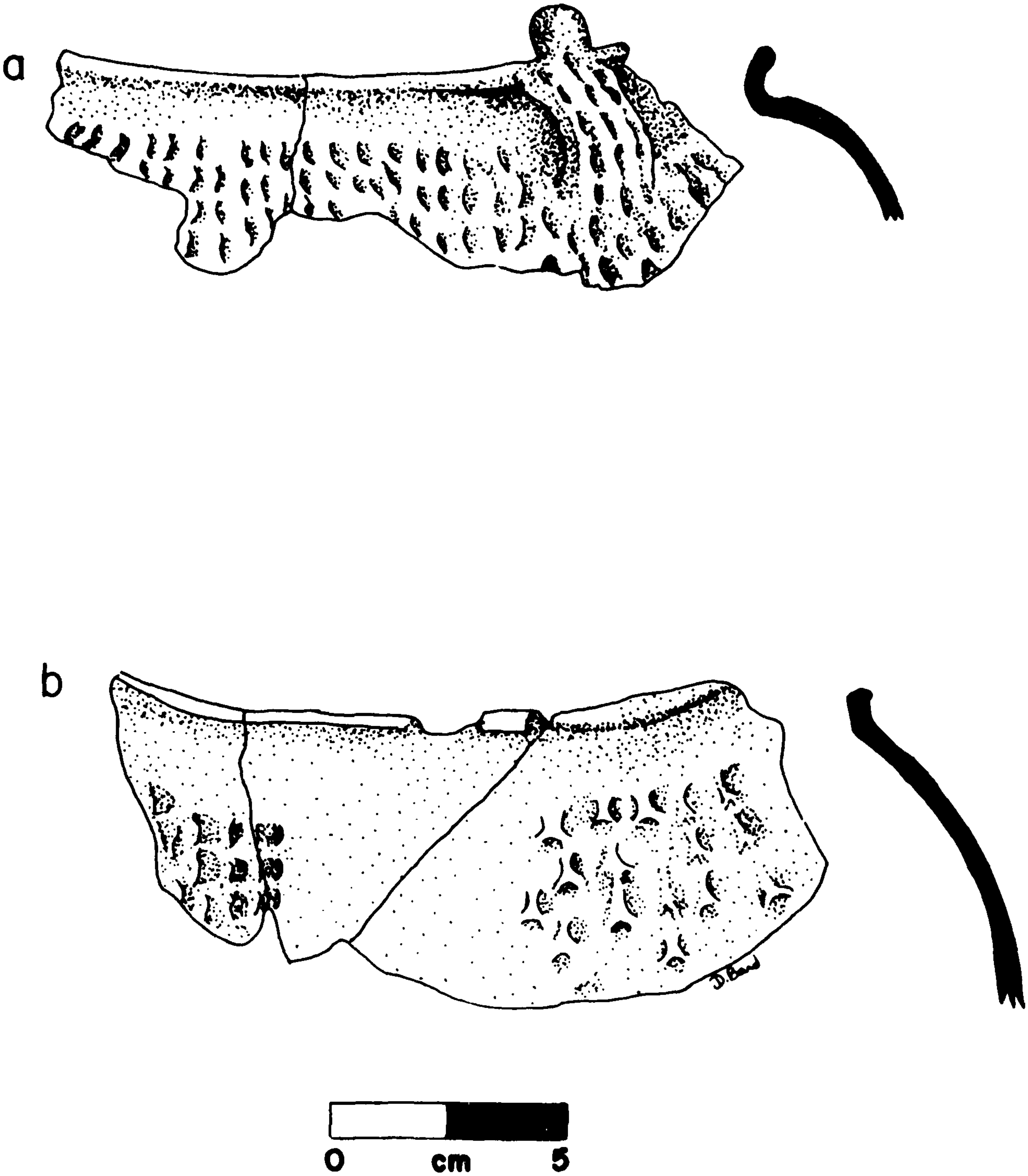


Figure 37. Parkin Punctated var. Unspecified, short neck bowl fragments.

reached on how they should be classified as to type and varieties.

UNCLASSIFIED INTERIOR ENGRAVED

A single example of an engraved design which did not fit into descriptions of the engraved types and varieties for this area was recovered from the Lubbub Creek Archaeological Locality. The design was an engraved ellipse which was bisected lengthwise by a single engraved line; perpendicular to this line, engraved lines were executed at short intervals. This pattern of cross-hatching is very similar to the design executed on the interior base areas of some coarse shell tempered ceramics (Figure 43e), but in this case, the cross-hatching was confined within an oval shape.

UNCLASSIFIED PUNCTATE

One sherd with random punctations was recovered which did not fit into the established types and varieties. The sherd was tempered with coarse shell, but was not large enough to determine vessel shape.

UNCLASSIFIED EXTERIOR INCISED

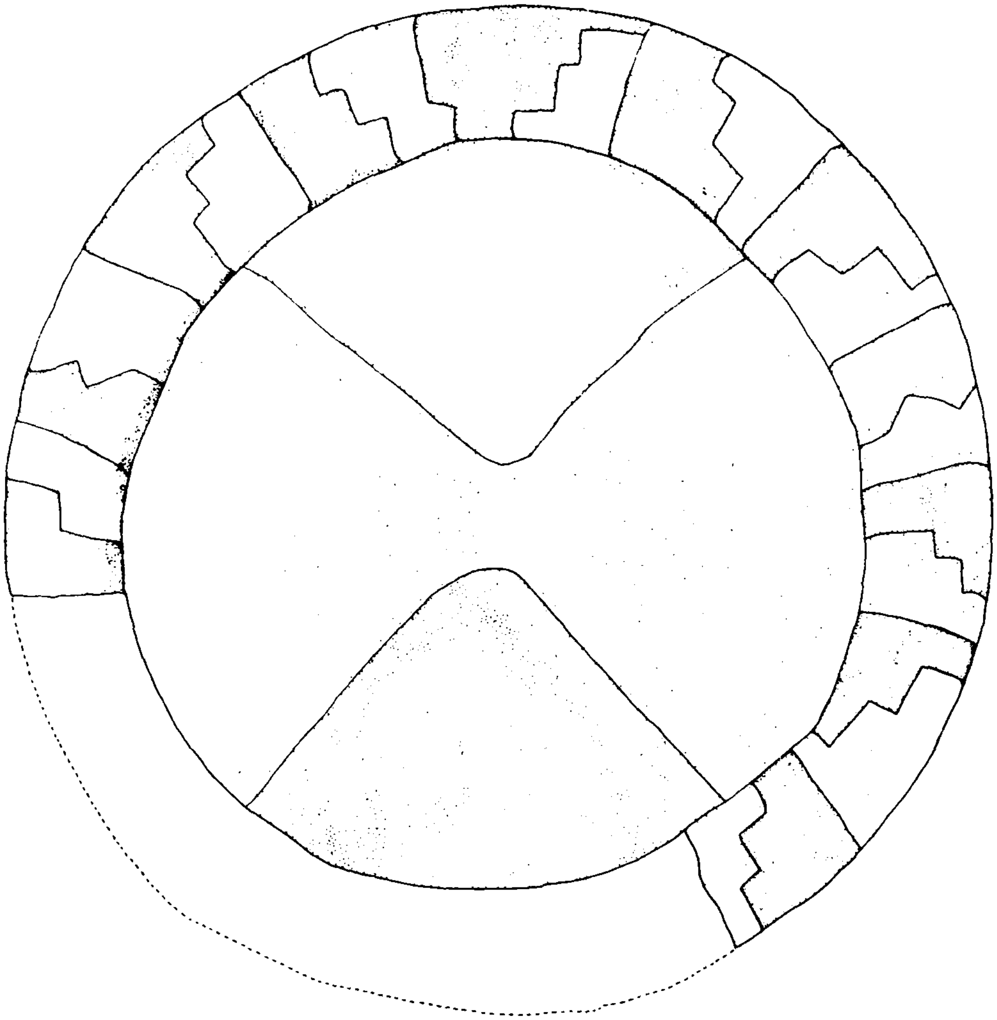
Twelve vessel fragments (Figures 39, 40) and one terraced rectangular vessel (Figure 41) were placed in this category. Of the twelve Unclassified Exterior Incised vessel fragments shown in Figures 39 and 40, eight have curvilinear designs incised on the shoulder area, and the remaining four sherds have rectilinear designs confined to the shoulder area. All examples shown in Figures 39 and 40 would be from carinated bowls, restricted bowls, or neckless jars. Because of the unusual vessel forms and designs, these vessels are thought to date late in the Summerville sequence, but their exact chronological position is not known. Three of these sherds were shell tempered and four were mixed fine shell and grog.

One vessel described as Unclassified Exterior Incised was of the unusual terraced rectangular vessel form (Figure 41). This vessel was constructed by a slab built tradition; the base and walls were built as flat individual units and then joined to form the completed vessel. The unusual exterior incisions on this vessel are shown in Figure 42. This vessel had a scalloped rim and was tempered with fine shell. Based on analogues from Moundville (Peebles 1978; Steponaitis 1980:Fig. 63) this vessel can be assigned a date early in the Summerville sequence.

UNCLASSIFIED INTERIOR INCISED

Eight interior incised designs (Figure 43a-h, 44a-b) could not be classified in the established types and varieties for this area. Most (88.9 percent) were incised on the interior rim areas of flaring rim bowls, 2.8 percent were on the interior rim of outslanting bowls, 5.6 percent on the interior base area of simple bowls, and 2.8 percent on the interior base of miscellaneous bowls.

The majority (57.3 percent) of the sherds placed in the Unclassified Interior Incised category had simple rectilinear incisions (Figure 43a). Because the difference between the simple rectilinear design of the Unclassified Interior Incised wares and that of Carthage Incised var. Moon



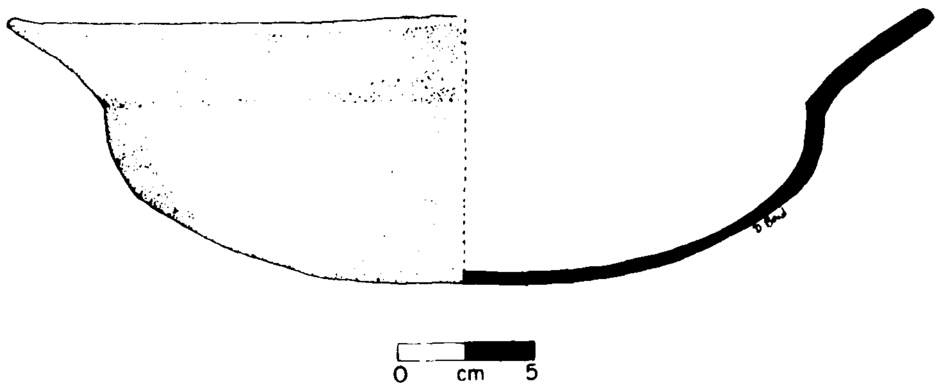


Figure 38. Unclassified Interior Red Painted Burial Urn Cover.

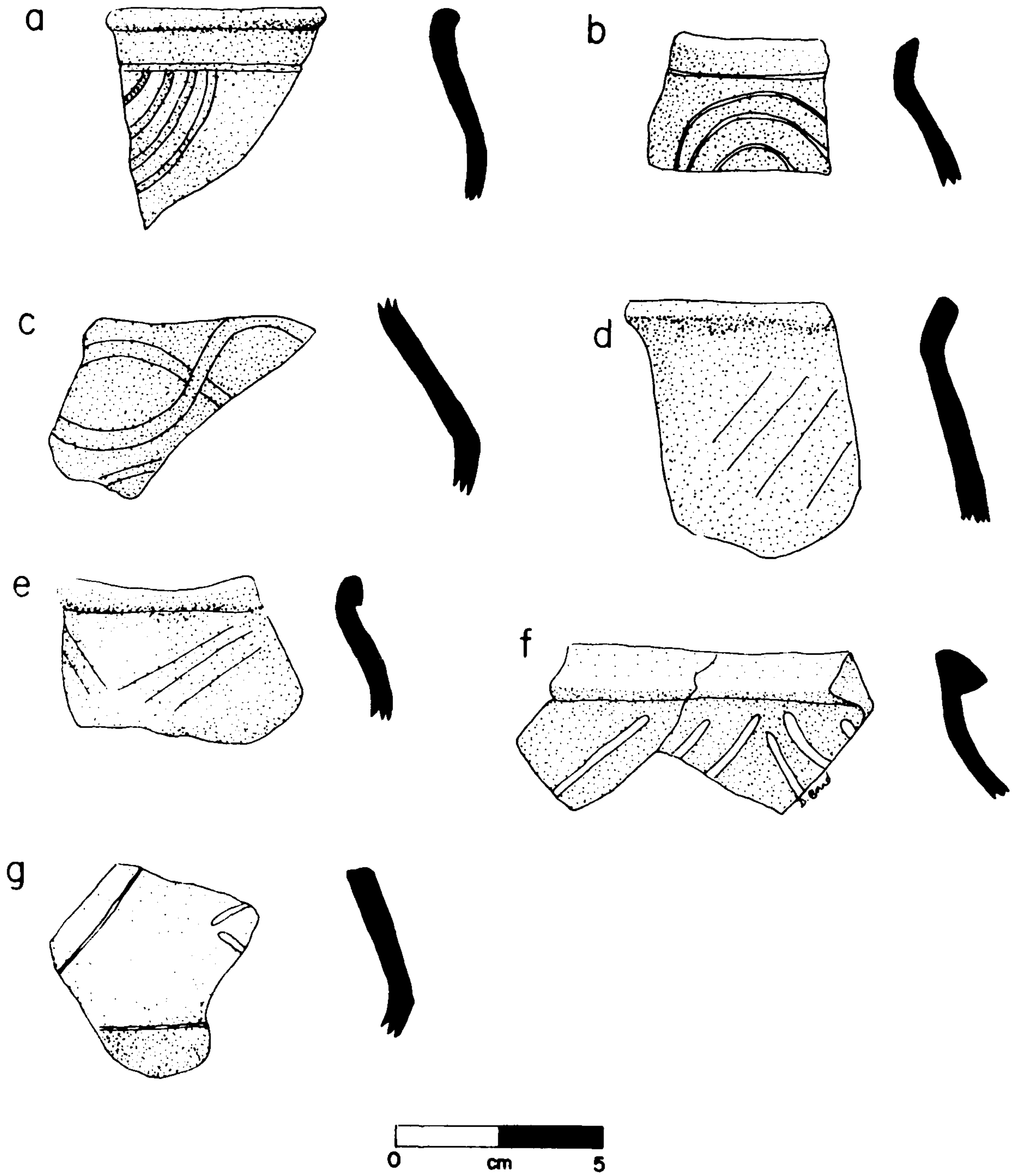


Figure 39. Unclassified Exterior Incised.

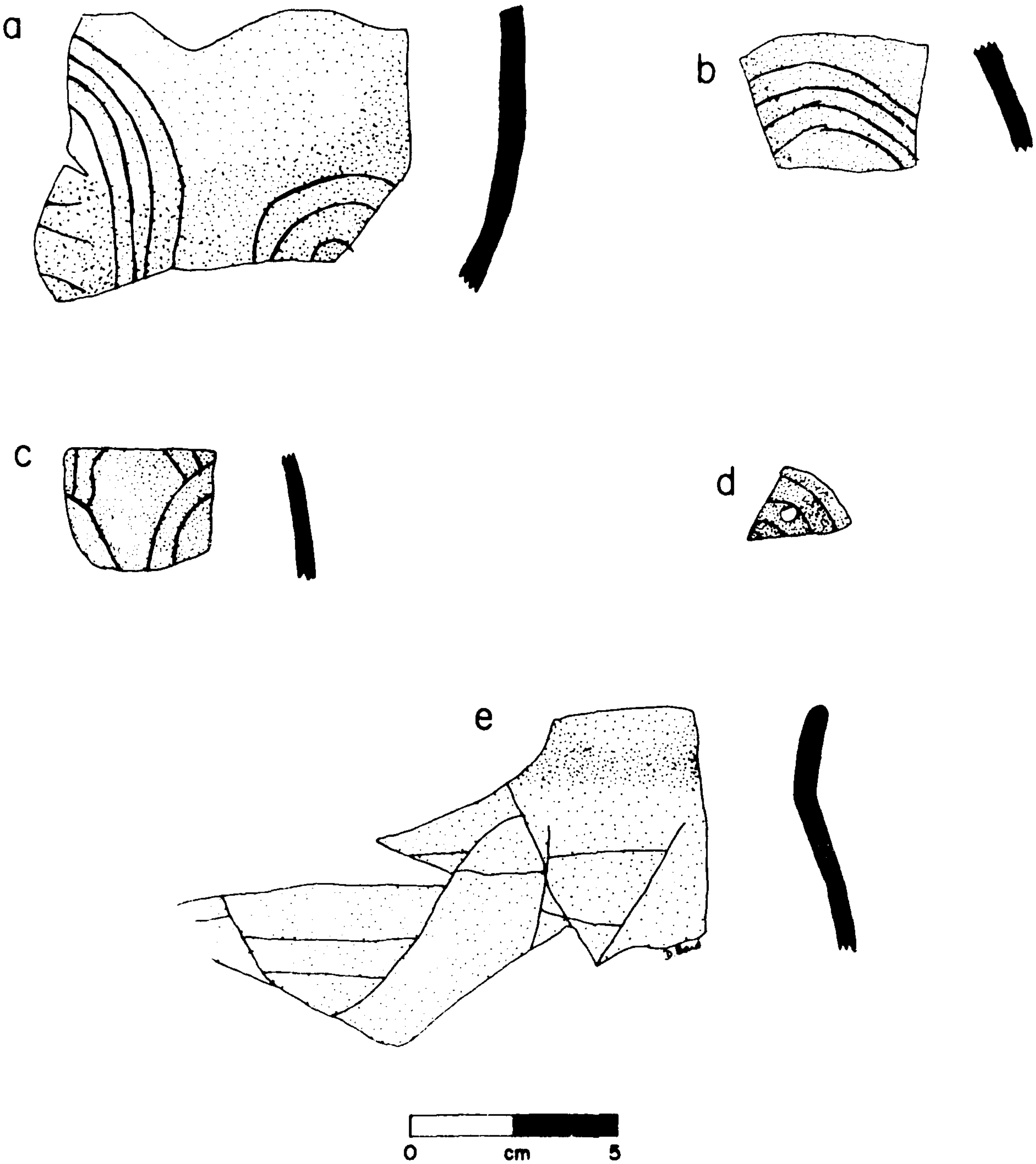


Figure 40. Unclassified Exterior Incised.

var. Taylorville, and var. Wiggins.

Material recovered from the Lubbub Creek Archaeological Locality included artifacts which could indicate the presence of a ceramic workshop on the site. These artifacts included fragments of pottery trowels (Figure 50a-c). A few of the flaring rim bowls which, in the collections from the Moundville site, have been identified as possible molds for ceramic manufacturing could have served the same function in the Lubbub Creek Archaeological Locality. These vessel forms were most common in Carthage Incised var. Moon Lake.

In addition, numerous examples of what were called fired coils (Figure 50d) and lumps of prepared clay (clay which had temper added) which had become fired for no apparent reason were recovered from the Lubbub Creek Archaeological Locality. Fired coils were both thick and thin. Research on these coils which included measuring their temper size and thickness would help answer questions concerning the manufacture of the coarse and fine shell tempered Mississippian ceramics.

Historic Choctaw Ceramics

Only one type of ceramic was recovered from the Lubbub Creek Archaeological Locality which was from a historic Choctaw occupation on the site. This type was called Chickachae Combed.

CHICKCHAE COMBED

Documentation: Collins 1927; Penman 1980.

General Description

Four sherds of historic Chickachae Combed were recovered from the Lubbub Creek Archaeological Locality. These ceramics were fine grog tempered and were very similar in appearance to the fine mixed shell and grog tempered ceramics found from earlier Mississippian occupations. The major point of distinction was the highly burnished surface which was decorated with very thin lined combed incisions (Figure 51). The decoration appeared to have been applied to the vessel surface after the paste had dried to a bone dry state or was fired. Because of this, the decorations could be called engravings. The decoration consisted of three to five parallel lines which appeared to have been applied with a comb-like tool. All examples of this decoration were on simple bowl forms.

Pre-Mississippian Types and Varieties

Because of the recently completed comprehensive research by Jenkins (1979a) on the pre-Mississippian ceramic assemblages in the Gainesville Lake area, the author followed Jenkins sorting criteria for the pre-Mississippian ceramics recovered from the Lubbub Creek Archaeological Locality. A brief description of each type and variety encountered at Lubbub Creek will be presented in this section by temper grog. There was neither sufficient sample size nor sufficient variation in the materials recovered to carry the analyses of these ceramics beyond the type and variety level.

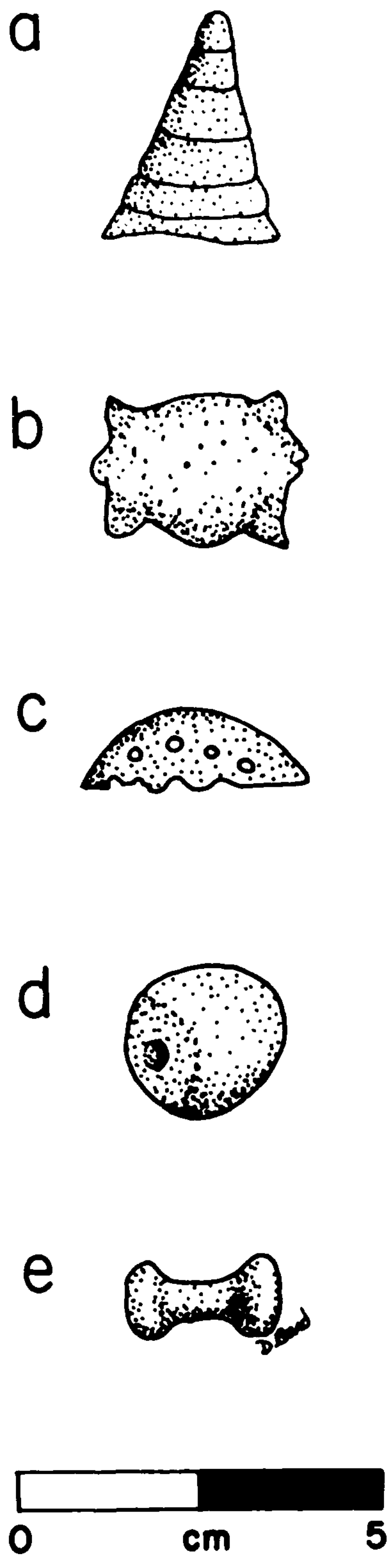


Figure 49. Shell tempered ceramic objects.

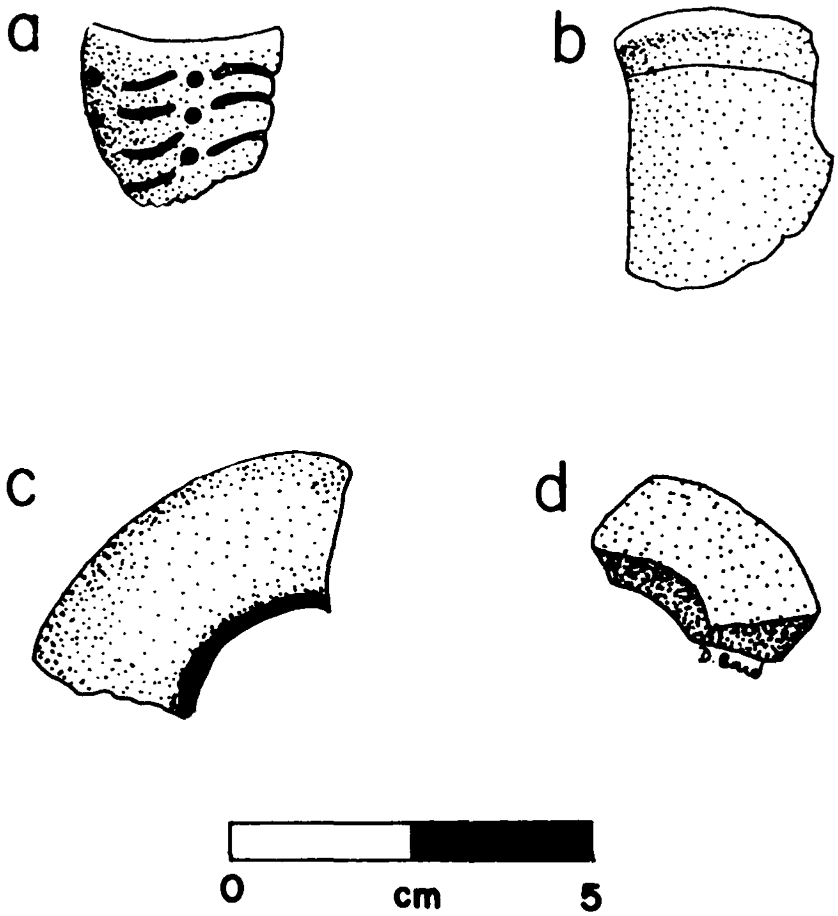


Figure 48. Shell tempered pipe fragments.

been a small ear plug.

Possible Variation in Mississippian Ceramic Technology

There appeared to be a number of different technological variations in the manufacture of the Mississippian vessels recovered from the Lubbub Creek Archaeological Locality. The major technological differences are between the ceramics which are coarse shell tempered and those which are fine shell or mixed fine shell and grog tempered.

Before reading the remainder of this section, the reader would probably be well advised to read the Appendix to this chapter in which a brief discussion of specific ceramic traditions, e.g., the developments of a fineware and coarse ware traditions, is given for the ceramics of both Moundville and Lubbub Creek as viewed by two of the consultants for this project, Sander van der Leeuw and Margaret Ann Hardin. Evidence was sought, during the attribute analysis, for the different ceramic traditions discussed. Observations of traits indicative of these traditions were incorporated into the analysis.

With the completion of the analysis of the Mississippian ceramic assemblage recovered from the Lubbub Creek Archaeological Locality, the author believes that sufficient data was recovered to indicate that both of the complex traditions observed for the Moundville collections -- a coiling with hammer-and-anvil finishing tradition and a "rest" or mold assisted coiling tradition -- were present at the Lubbub Creek Archaeological Locality and each played an important role in the local ceramic assemblage. The technological tradition which seemed to play the most important role was the hammer-and-anvil finishing tradition as defined by van der Leeuw and Hardin in the Appendix. Ceramics which showed evidence for this tradition in this study included Mississippi Plain var. Warrior, Moundville Incised var. Moundville, var. Snows Bend, and var. Carrollton, and Parkin Punctated var. Unspecified.

Evidence for the hammer-and-anvil tradition in the later Alabama River phase materials was also noted. These materials were all classified as coarse shell tempered wares, whose surfaces were usually unburnished and smoothed. The best evidence for the hammer-and-anvil finishing technique on coil-built vessels is the slight faceted effect this technique leaves on the body of the vessel. Evidence of this finishing tradition is observed best on vessels which were unburnished and smoothed, but even then the faceted surface is often obliterated by the smoothing of the surface. The evidence strongly suggests the existence of a coiled, hammer-and-anvil tradition at the Lubbub Creek Archaeological Locality. Further research should allow for a distinction to be made between ceramics which were built by coiling and were then smoothed, and those which were built by coiling, then had their coils compacted by use of the hammer and anvil, and were then smoothed.

Evidence for the second complex ceramic manufacturing tradition, described as a "rest"- or mold-assisted coiling tradition, was confined to the fine shell tempered wares. The rest or mold allowed the potter to turn the vessel while it was being constructed, as described by van der Leeuw. Vessels which were constructed by use of a rest or mold and small coils could have occurred in the following types and varieties: Bell Plain var. Big Sandy, Mississippi Plain var. Hale, Moundville Engraved var. Fosters,

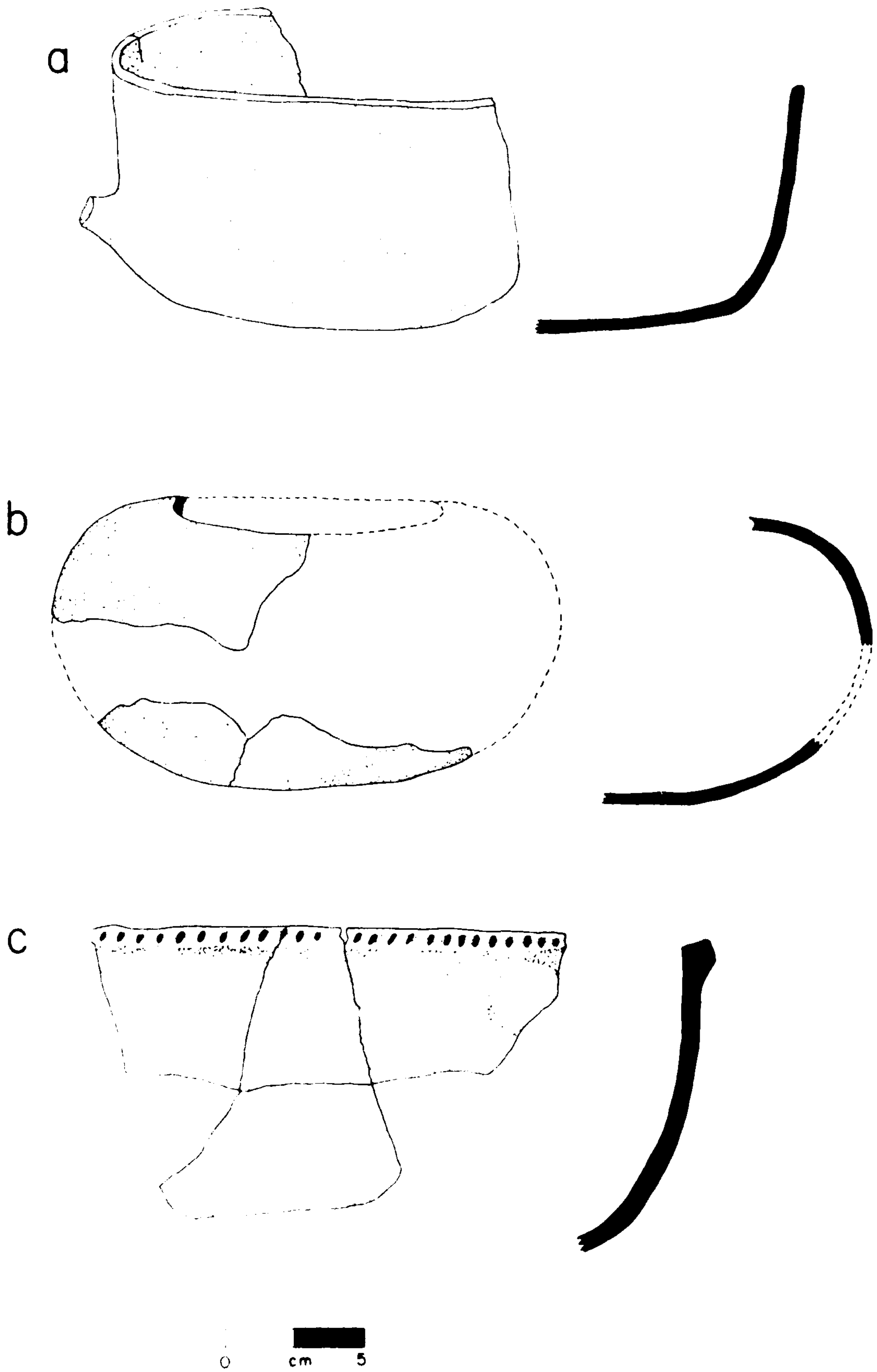


Figure 47. Unclassified Plain and Mississippi Plain; a-b, Unclassified Plain var. Unspecified; c, Mississippi Plain var. Hale, simple bowl with a folded flattened rim which was beaded on the exterior.

the exterior, and 23.8 percent on both the interior and exterior surfaces. Of the red painted wares examined, 85.7 percent were shell tempered and 14.3 percent were mixed fine shell and grog tempered. One folded rim and one folded flattened rim were noted.

Of the remaining painted ceramics, 15.9 percent were classified as white painted. Of these painted wares, 42.8 percent were deemed indeterminate for further analysis because only the painted surface remained intact. No vessel forms could be identified for these ceramics. Deliberate surface coloration was noted on the interior of 25 percent of the sherds examined, while the remaining 75 percent were painted on the exterior. All examples of white painted materials were shell tempered with no grog inclusions.

The last kind of painted ceramics recovered from the Lubbub Creek Archaeological Locality was red and white painted, of which only two examples were recovered. One sherd was deemed indeterminate for further analysis, because only the painted surface was intact. The other red and white painted sherd was a fragment of a flaring rim bowl, with the coloration confined to the interior surface. Both surfaces of the sherd were burnished, and it was shell tempered.

UNCLASSIFIED PLAIN

Two vessel fragments exhibited characteristics which caused the author to doubt that they had a common origin with the other plain Mississippian ceramics. Figure 47a shows a simple bowl fragment which appeared to have a handle or effigy broken from the lower body wall. The vessel was tempered with dense grog and sparse very fine shell. The exterior surface was highly burnished and was a mottled color which ranged from tan to deep reddish brown. This surface coloration was exhibited only on this vessel, the other Unclassified Plain vessel fragment (Figure 47b) and an effigy bowl fragment (Figure 6a). The coloration was thought to be deliberate, but the method for application is not known.

The other vessel fragment which was placed in this category (Figure 47b) was a restricted bowl fragment whose vessel profile was complete except for a small segment between the upper body and the base. The paste of this fragment was the same as the other vessel fragment placed in this category. The point should be made that the coloration of these vessels was possibly achieved through firing in an oxidizing atmosphere. The exterior surfaces of both were highly burnished.

SHELL TEMPERED PIPE FRAGMENTS AND CERAMIC OBJECTS

Four shell tempered pipe fragments (Figure 48a-d) were recovered from the Lubbub Creek Archaeological Locality. Two pipe fragments (Figure 48a-b) had incisions on their exterior surface for decoration, but the remaining two shell tempered pipe fragments were undecorated.

Five shell tempered objects (Figure 49) were also recovered from the Lubbub Creek Archaeological Locality. Figure 49a is an incised cone-shaped object, Figure 49b is a punctated object which is sometimes called a "toy turtle," Figure 49c is a perforated shell tempered discoidal, Figure 49d is a shell tempered bead, and Figure 49e is a dumbbell shaped object which may have

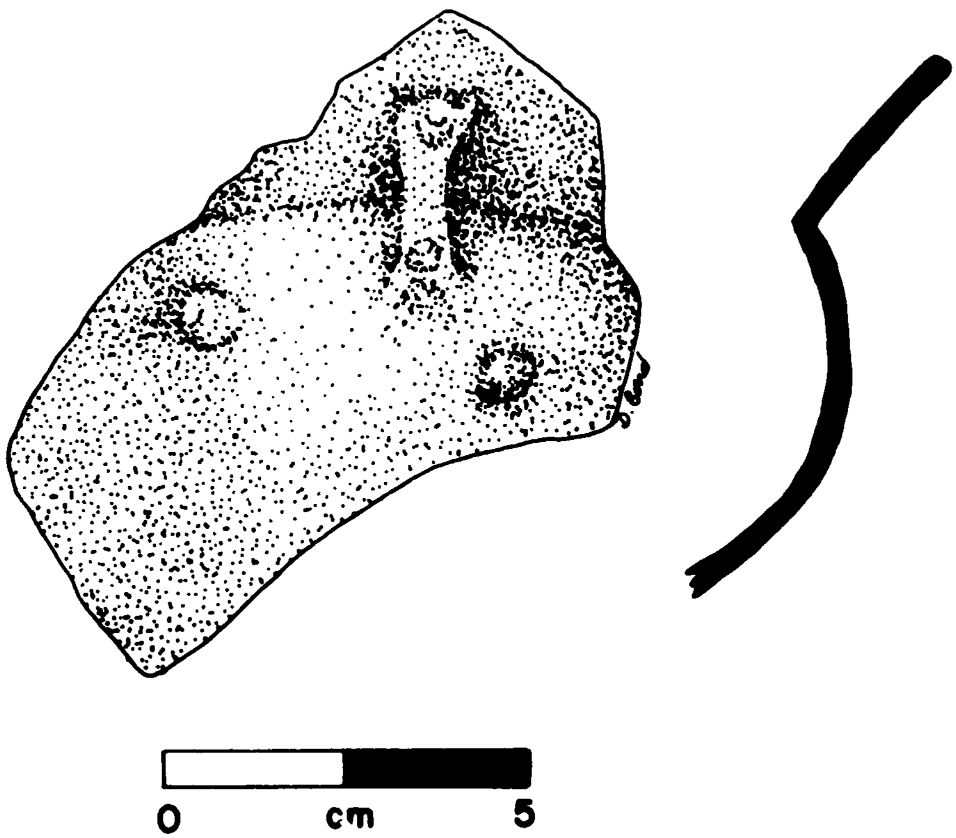


Figure 46. Unclassified Noded var. Unspecified.

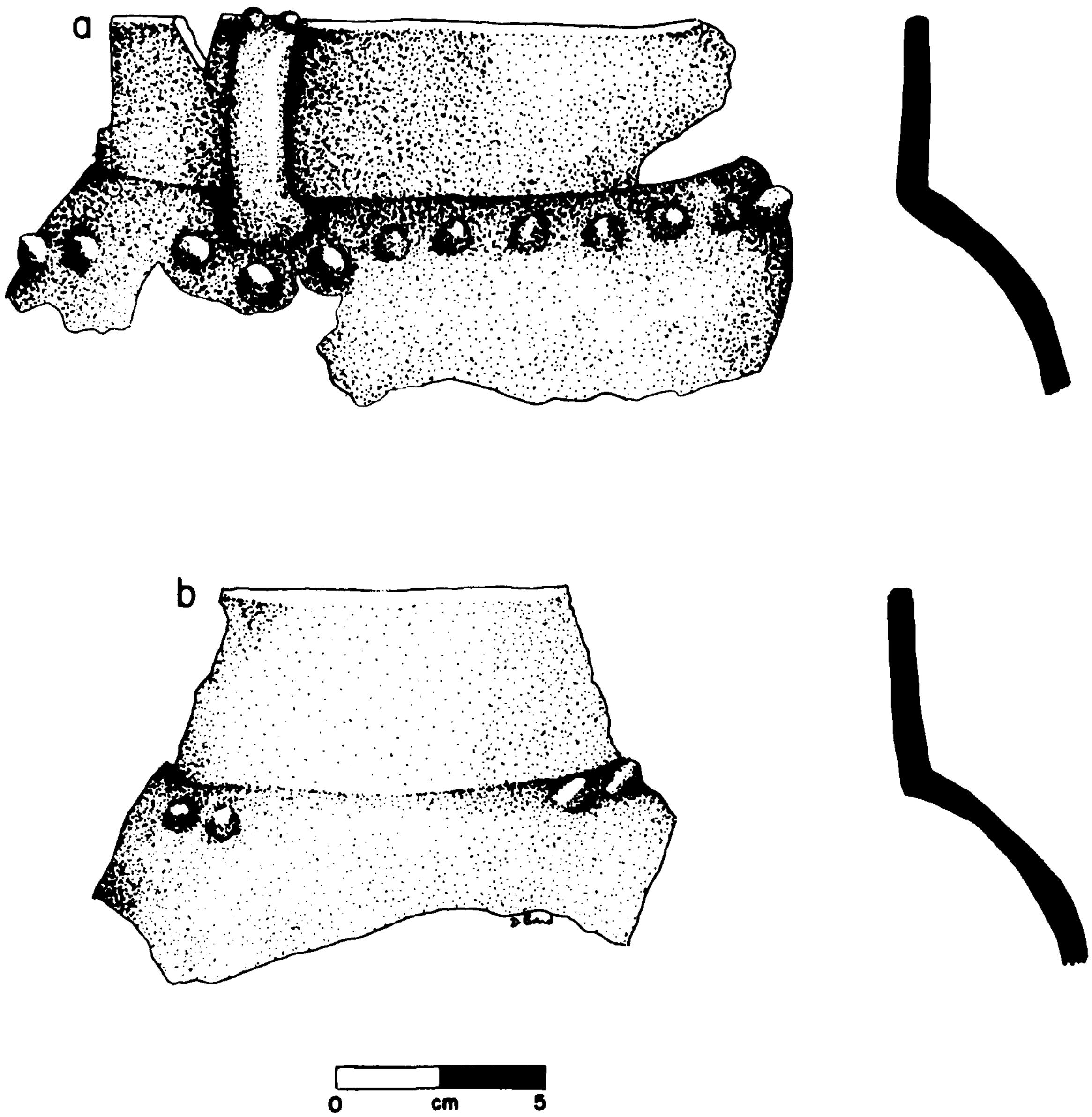


Figure 45. Unclassified Noded and Mississippi Plain: a, Unclassified Noded var. Unspecified; b, Mississippi Plain var. Warrior, with noded shoulder.

The last Unclassified Interior Incised design was an incomplete motif (Figure 43h). Enough of the design was present to distinguish it from the other Unclassified designs, but the entire motif could not be identified. The design was executed on a shell tempered paste. Temper size ranged from 1.8 mm to 1.9 mm. Mean temper size was 1.85 mm (n=2; s=0.71). Line width ranged from 1.2 mm to 1.5 mm. Mean line width was 1.35 (n=2; s=0.21).

One scalloped rim and one notched rim were noted for the Unclassified Interior Incised material.

UNCLASSIFIED INTERIOR RED PAINTED

One sherd of Unclassified Interior Red Painted was recovered from the Lubbub Creek Archaeological Locality. This sherd was noted because of its similarity to ceramics recovered in the Black Warrior drainage (Curren, personal communication). This was a coarse shell tempered miscellaneous jar fragment with a red painted interior.

UNCLASSIFIED NODED

This category was established to note the presence of ceramics which were decorated with nodes of clay on their exterior vessel walls. Three sherds with such nodes were noted for the entire collection. Figure 45a shows a standard jar fragment which was decorated with an arch motif formed by the addition of nodes to the shoulder area. The node placement most closely follows the design placement of Moundville Incised var. Other in which the end points of the arches are positioned below handle attachments. Both the interior and exterior surfaces of this sherd were without deliberate surface coloration, but both surfaces were unburnished and smoothed. The sherd was tempered with shell.

Positive identification of the design was not possible for the other two sherds (Figure 45b, 46) placed in this category. Both were coarse shell tempered.

UNCLASSIFIED PAINTED CERAMICS

The examples of painted ceramics recovered from the Lubbub Creek Archaeological Locality which were identifiable to vessel shape were few because of the very fragmented nature of the painted ceramics. Two of the exceptions -- the red painted burial urn cover and an Unclassified Interior Red Painted jar fragment -- have been discussed earlier in this chapter and were not included under this heading.

Of the 1751 sherds studied in the attribute analysis, 2.5 percent were painted in some fashion. Of the painted ceramics, the red painted wares were by far the most numerous; they made up 77.3 percent of all painted wares. Of these red painted wares, 38 percent were considered indeterminate for analysis because only the painted surface was present and they were so small that observations of vessel shape and location of deliberate surface coloration could not be made. Of the remaining 62 percent identified as red painted, two miscellaneous bowl fragments, one cylindrical bowl fragment, and three flaring rim bowl fragments were identified. The deliberate surface coloration was on the interior surface of 57.1 percent of the sherds, 19 percent were painted on

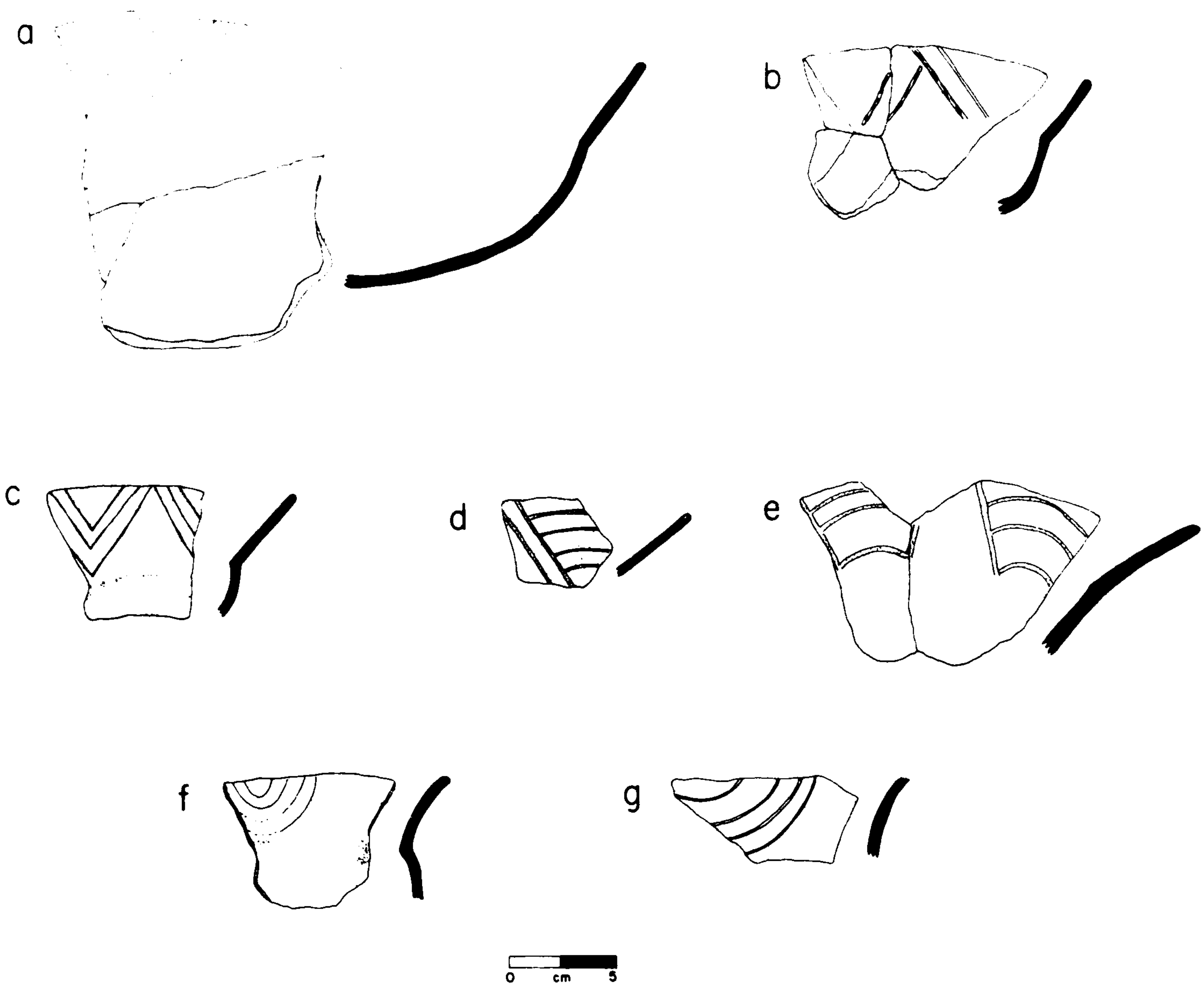


Figure 44. Unclassified Interior Incised: a-b, simple rectilinear; c, running rectilinear; d, bordered incised; e, zoned curvilinear; f-g, nested curvilinear.

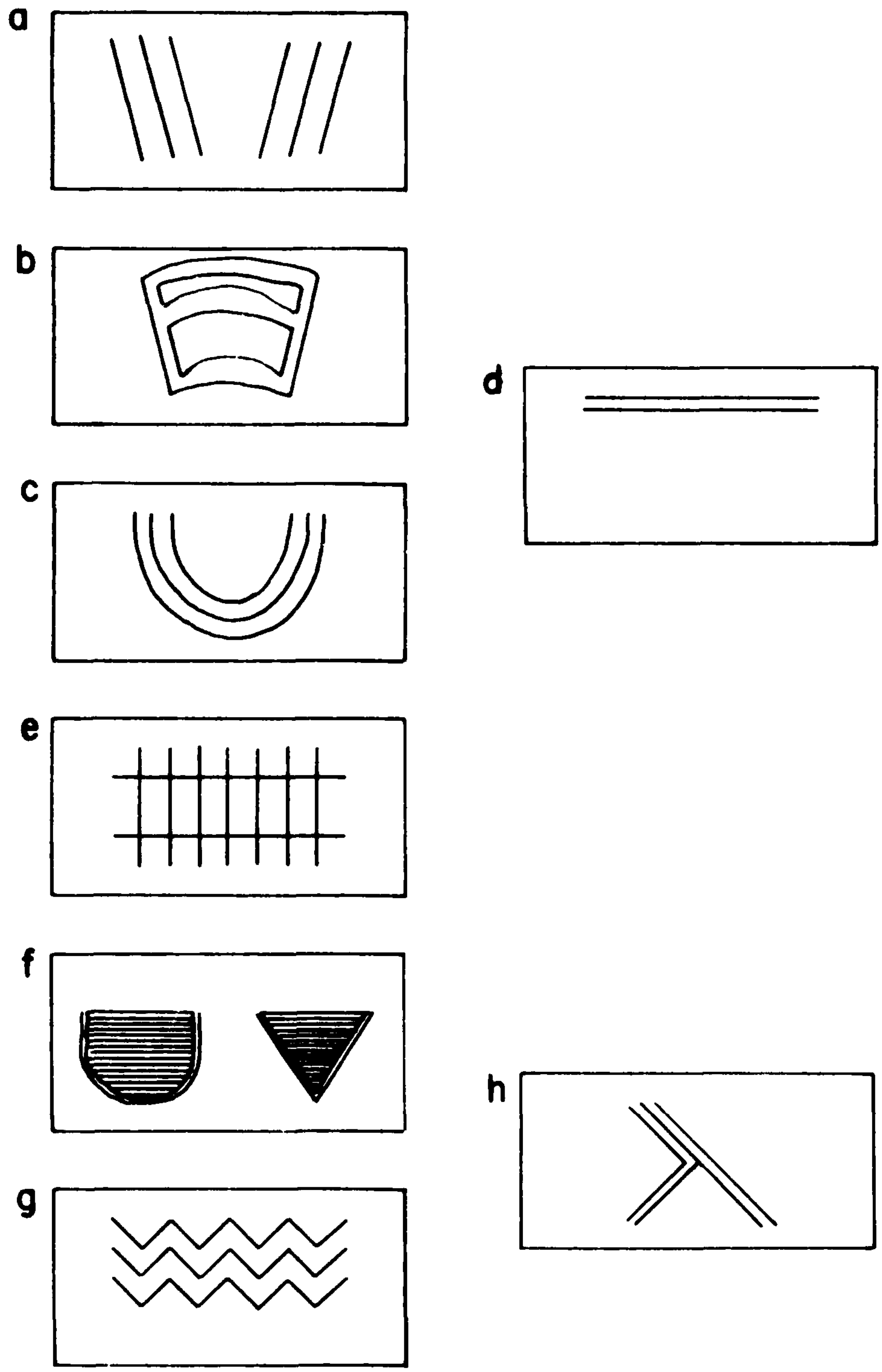


Figure 43. Unclassified Interior Incised Designs: a, simple rectangular; b, zoned curvilinear; c, nested curvilinear; d, parallel incision to the rim; e, interior base incised; f, bordered incised; g, running rectilinear; h, other unclassified interior incised.

Lake was only the condition of the clay at the time of incision, this category was included with the Carthage Incised var. Moon Lake ceramics and were discussed under that variety.

Of the unclassified sherds with simple rectilinear designs, 91.7 percent were shell tempered, and the remaining 8.3 percent were tempered with mixed shell and grog. Temper size ranged from 0.4 mm to 2.7 mm. Mean temper size was 1.4 mm (n=57: s=0.55). Of the 51 sherds with simple rectilinear designs, 14 (27 percent) were smudged or blackfilmed. The location of this deliberate coloration was on the interior alone on 20 percent of the sherds, on the exterior surface alone on 6.7 percent, and on both the interior and exterior surfaces of 73.3 percent. The exterior surfaces of 56 percent were burnished, and 44 percent were unburnished and smoothed. The interior surfaces of 68.6 percent were burnished, 29.4 percent were unburnished and smoothed, and 2 percent were unburnished and scraped.

The next most common Unclassified Interior Incised design was described as interior base incised. Sherds which exhibited incisions on their interior base areas comprised 9 percent of all Unclassified Interior Incised wares. The design executed on the base area consisted of neatly executed simple cross-hatching (Figure 43e, 34j-i). This design was placed on the interiors of small simple bowls. The temper of 87.5 percent of the sherds with this design was shell, and 12.5 percent were tempered with mixed shell and grog. Temper size ranged from 0.7 mm to 2.7 mm. Mean temper size was 1.71 mm (s=0.58). The line width ranged from 0.7 mm to 3.8 mm. Mean line width was 1.47 mm (s=1.04).

The next three designs each comprised 7.9 percent of the sherds in this category. The first, described as zone curvilinear (Figure 43b, 44e), was simply three arches placed one above the other and zoned by oblique lines which ran from the ends of the top incision to the ends of the bottom incision. The arch closest to the rim was the longest, and the arch closest to the base, the shortest.

Nested curvilinear designs (Figure 43c, 44f-g) were very similar to the Walls Engraved var. Hull designs described by Phillips (1970:170). The end points of the concentric arches were oriented both toward and away from the rim.

The bordered incised design (Figure 43f, 44d) or line filled triangles and line filled crescents were found on the interiors of flaring rim bowls.

A design of incised lines parallel to the rim on the interior of flaring rim bowls (Figure 43d, 34f) was present on 5.6 percent of the sherds in the Unclassified Interior Incised category. This design is very similar to the design described as D'Olive Incised by Coblentz (personal communication).

The last two designs in the Unclassified Interior Incised category were each represented on 2.2 percent of the sherds in this category. The first was called running rectilinear (Figure 43g, 44c) and was found on the interior rim areas of flaring rim bowls. This design was a continuous angular pattern which consisted of three lines. The design was incised on shell tempered vessels. Temper size ranged from 1.2 mm to 1.6 mm.

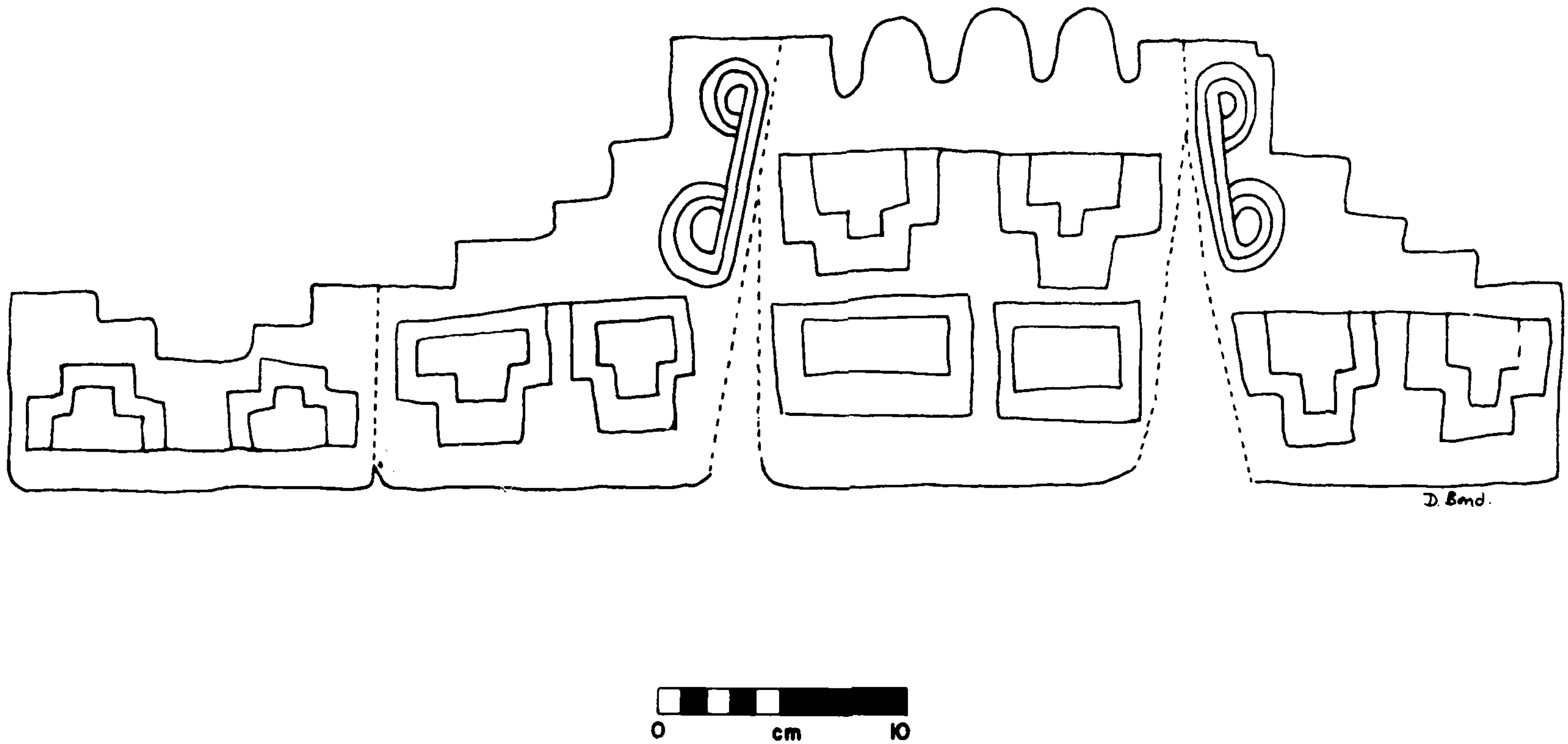


Figure 42. The Unclassified Exterior Incised design which decorated the terraced rectangular vessel (Figure 41) shown as viewed on a single plane.

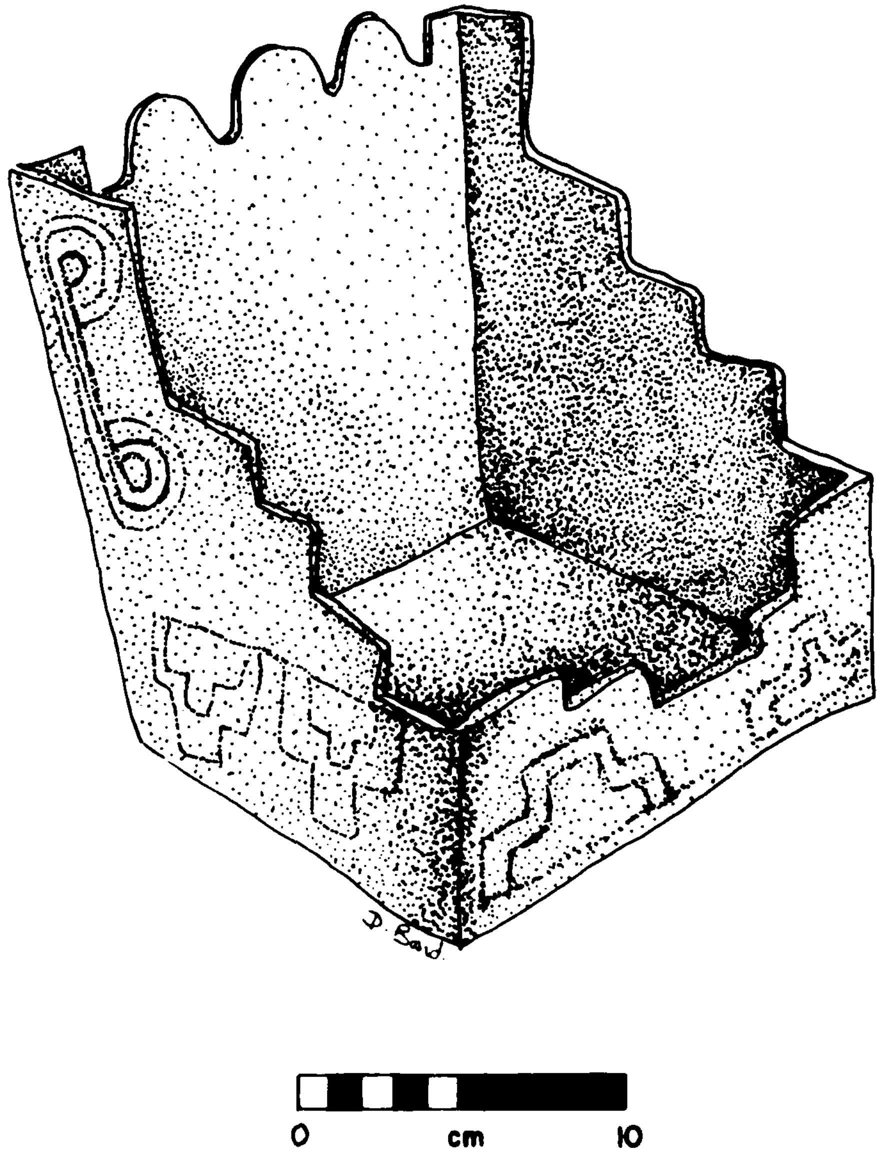


Figure 41. Unclassified Exterior Incised, terraced rectangular bowl.

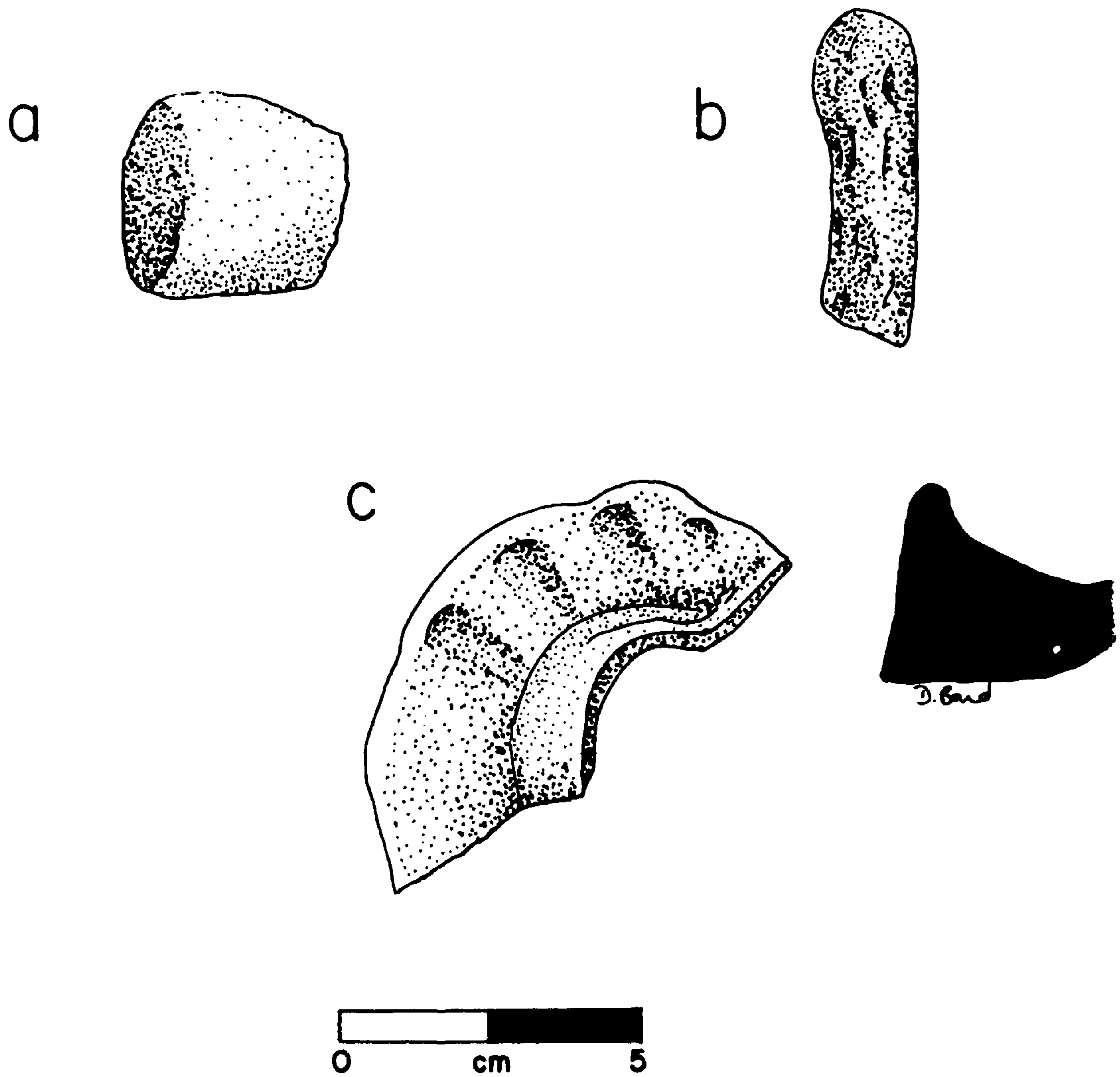


Figure 50. Shell tempered ceramic objects.

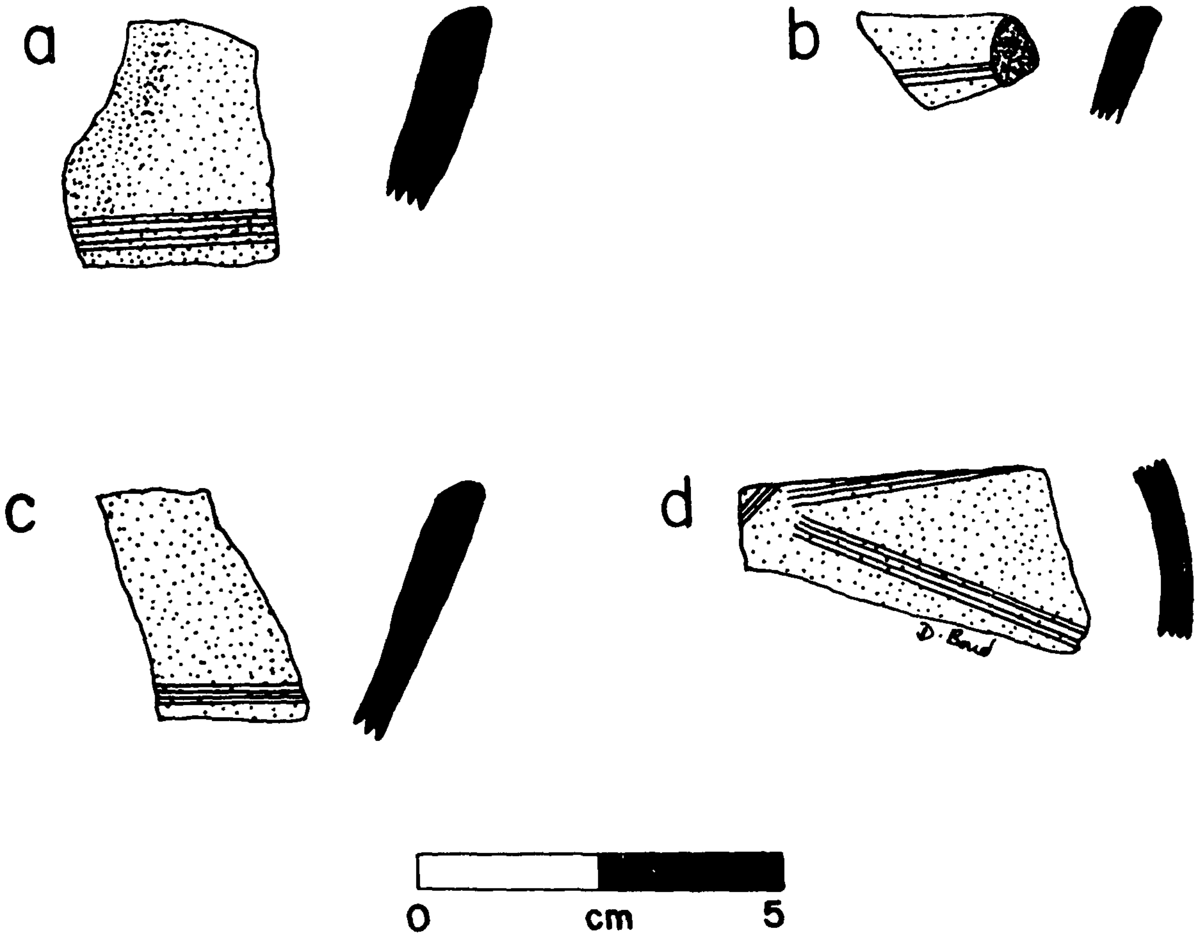


Figure 51. Chickachae Combed var. Unspecified

GROG TEMPERED CERAMICS

Locally made grog tempered ceramics probably made their earliest appearance in the central Tombigbee drainage during the Miller II phase which, as defined by Jenkins (1979a), would probably date between 300 and 550 A.D. At around A.D. 550, the percentage of sand tempered ceramics declined and the grog tempered ceramics became the dominant types. As Jenkins (1979a:263) stated: "The beginning of Miller III has previously been defined by the appearance and dominance of grog tempered pottery..." Jenkins points to the weakness of this distribution between Miller II and Miller III because as much as 30 percent of the Late Miller II ceramic assemblage can be comprised of grog tempered ceramics.

Based on this earlier research, the grog tempered ceramics from the Lubbub Creek Archaeological Locality appear to be from the Middle Miller III subphase. (Note, however, that a recent seriation by Jenkins and Peebles would place the Middle Miller III subphase at the very end of the Miller III sequence.) Neither earlier sand tempered types nor later shell tempered types were found in the Miller III features. Also, in the central Tombigbee drainage, in Middle Miller III contexts, Mulberry Creek Cord Marked _var. Aliceville_ is always found in a 2:1 ratio with the next most common variety, Baytown Plain _var. Roper_. This is the ratio in which these two varieties occurred in Miller III features at the Lubbub Creek Archaeological Locality. It appears, then, that the grog tempered ceramics recovered from the Lubbub Creek Archaeological Locality represent a distinct Middle Miller III occupation.

ALLIGATOR INCISED

Documentation: Phillips 1970; Jenkins 1979a.

General Description

Alligator Incised was defined by Jenkins (1979a:95) as "sloppy rectilinear incisions executed in a wet paste." Alligator Incised ceramics are grog tempered and exhibit variation in the density of grog in the paste. Three varieties were defined for this type by Jenkins (1979a:95), two of which were recovered during the course of this research: _var. Oxbow_, which is "sloppy random incisions which form no discrete design" (Jenkins 1979a:96) and _var. Gainesville_, whose sloppy incisions "form triangular arrangements of decorations" (_ibid_.:96). Five rims and 21 body sherds of _var. Oxbow_ were recovered, and one rim and seven body sherds of _var. Gainesville_ were recovered. The Alligator Incised designs were incised on the exteriors of simple and outslanting bowls.

BAYTOWN PLAIN

Documentation: Phillips, Ford, and Griffin 1951; Ford, Phillips, and Haag 1955; Greengo 1964; Koehler 1966; Phillips 1970; Jenkins 1979a.

General Description

Baytown Plain ceramics are grog tempered, undecorated ceramics whose varieties are distinguished on the basis of the relative amounts of grog,

sand, and shell in the paste. Variety Roper, as defined by Jenkins (1979a:104), "is a dense grog variety containing only a small amount of sand in the paste." Jenkins described var. Tishomingo as having "a small amount of grog in the paste and much sand." Variety Curry Creek was defined to account for plain grog tempered sherds with shell inclusions.

Variety Roper was represented by 377 rim and 4,110 body sherds. Variety Tishomingo was represented by 28 rim and 426 body sherds, and var. Curry Creek was represented by eight body sherds. The vessel forms for these varieties are simple or outslanting bowls.

MULBERRY CREEK CORD MARKED

Documentation: Haag 1939; Phillips, Ford, and Griffin 1951; Ford 1951; Ford, Phillips, and Haag 1955; Koehler 1966; Phillips 1970; Oakley and Futato 1975; Jenkins 1979a.

General Description

Mulberry Creek Cord Marked ceramics are grog tempered and are decorated with impressions of twined cordage. These impressions can be produced by single cord impressions or by slapping the vessel with a cord-wrapped paddle. Variation in the proportions of grog and sand in the paste distinguishes the varieties. Jenkins stated the difference between the two local defined varieties was that "var. Aliceville is characterized by a dense amount of grog in the paste and sparse sand, whereas var. Tishomingo is characterized by more sand and less grog" (Jenkins 1979a:124-125).

Variety Aliceville was represented in the collection from the Lubbub Creek Archaeological Locality by 434 rim and 6,007 body sherds, and var. Tishomingo was represented by 22 rim sherds and 403 body sherds. The vessel fragments recovered indicated that the common vessel forms for this type were simple, cylindrical, and outslanting bowls.

WITHERS FABRIC MARKED

Documentation: Phillips, Ford, and Griffin 1951; Haag 1952; Ford, Phillips, and Haag 1955; Phillips 1970; Jenkins 1979a

General Description

Withers Fabric Marked ceramics are grog tempered ceramics whose exterior surfaces have been decorated with "fabric wrapped and/or cord wrapped dowels" (Jenkins 1979a:134). Sherds were sorted into varieties on the basis of two criteria. 1) whether the dowel was single or multiple wrapped and 2) the paste of the sherd. Of the four varieties described by Jenkins (1979a), only two were recovered from the Lubbub Creek Archaeological Locality during this study: var. Gainesville and var. River Bend. Variety Gainesville is tempered with coarse grog and sparse sand and was decorated with a multiple wrapped dowel. Variety River Bend was also tempered with coarse grog and sparse sand, but was decorated with a single wrapped dowel.

Variety Gainesville was represented in the collection by 9 rim and 222 body sherds, and var. River Bend was represented by 1 rim and 35 body sherds.

Vessel forms represented appeared to be simple and outslanting bowls.

GAINESVILLE SIMPLE STAMPED

Documentation: Jenkins 1979a.

General Description

Gainesville Simple Stamped is a grog tempered type whose distinctive characteristic is "an overall surface treatment of groups of parallel grooves randomly applied to the vessel surface" (Jenkins 1979a:118). A single variety is defined for the type var. Hickory (Jenkins 1979a), which, at the present time, includes all grog tempered simple stamped wares. At the Lubbub Creek Archaeological Locality, var. Hickory was represented by two rim and seven body sherds. Vessel form appeared to be simple bowls.

SOLOMON BRUSHED

Documentation: Phillips, Ford, and Griffin 1951; Phillips 1970.

General Description

Solomon Brushed ceramics are grog tempered ceramics whose exterior surfaces were roughened by brushing the surface with a handful of twigs or stiff grass. A single variety, var. Fairfield, has been defined for the Gainesville Lake area by Jenkins (1979a). Variety Fairfield was represented in the collection under study here by 4 rim and 14 body sherds. The sherds appeared to be from simple and outslanting bowls.

EVANSVILLE PUNCTATE

Documentation: Phillips 1970; Jenkins 1979a.

General Description

Evansville Punctate is a grog tempered type which includes "all unzoned punctated grog tempered ceramics except Tammany Pinched" (Jenkins 1979a:112). Three body sherds from bowls were recovered from the Lubbub Creek Archaeological Locality, and all had a paste composition the same as Baytown Plain var. Roper -- dense grog with a small amount of sand. All sherds belonged to var. Tishabee.

YATES NET IMPRESSED

Documentation: Phillips, Ford, and Griffin 1951; Phillips 1970: Jenkins 1979a.

General Description

Yates Net Impressed ceramics are grog tempered ceramics whose exterior surfaces were decorated by a net pressed into the surface. Variety Yates as defined by Jenkins (1979a) includes all grog tempered net impressed ceramics from the Gainesville Lake area. Variety Yates was represented in the present collection by one rim sherd, which appeared to be from a simple bowl.

OTHER GROG TEMPERED CERAMICS

The ceramics which were placed in this category were sherds which had combinations of decorations which would not allow placement in a single type. An example is a sherd on which the designs of Alligator Incised var. Gainesville were placed over Mulberry Creek Cord Marked var. Aliceville. Also included under this heading were incised sherds whose incisions were unusual and a small number of Marksville Incised and Marksville Stamped ceramics. The following is a description of these ceramics.

1) 19 sherds Alligator Incised var. Oxbow over Mulberry Creek Cord Marked var. Aliceville

2) 6 sherds Gainesville Simple Stamped var. Hickory over Mulberry Creek Cord Marked var. Aliceville

3) 3 sherds Alligator Incised var. Gainesville over Mulberry Creek Cord Marked var. Aliceville

4) 2 sherds Solomon Brushed var. Fairfield over Mulberry Creek Cord Marked var. Aliceville

5) 1 sherd Withers Fabric Marked var. Gainesville over Mulberry Creek Cord Marked var. Aliceville

6) 1 sherd Evansville Punctate var. Tishabee over Mulberry Creek Cord Marked var. Aliceville

7) 1 sherd Alligator Incised var. Gainesville over Mulberry Creek Cord Marked var. Tishomingo

8) 1 sherd Gainesville Simple Stamped var. Hickory over Mulberry Creek Cord Marked var. Tishomingo

9) 1 sherd Avoyelles Punctate over Mulberry Creek Cord Marked var. Aliceville

Three sherds of Marksville Stamped var. Manny were also recovered. These sherds were very similar to sherds of this variety illustrated by Jenkins (1979a:Figure 15a-f) from the Gainesville Lake area. One sherd of Marksville Incised var. Yokena was identified, and it was similar to a sherd of this variety illustrated by Jenkins (1979a:Figure 15h). One sherd of a Coles Creek Incised var. Unspecified simple bowl was recovered which had a single incised line which ran parallel to the rim.

GROG TEMPERED PIPE FRAGMENTS AND CERAMIC OBJECTS

Two grog tempered pipe fragments (Figure 52a-b) were recovered from the Lubbub Creek Archaeological Locality. Figure 52a shows the one example of an incised pipe fragment, and Figure 52b shows the single undecorated pipe fragment. Also shown (Figure 52c) is the single grog tempered bead which was ecovered and a grog tempered object which has been called a "dipper" (Figure 52d).

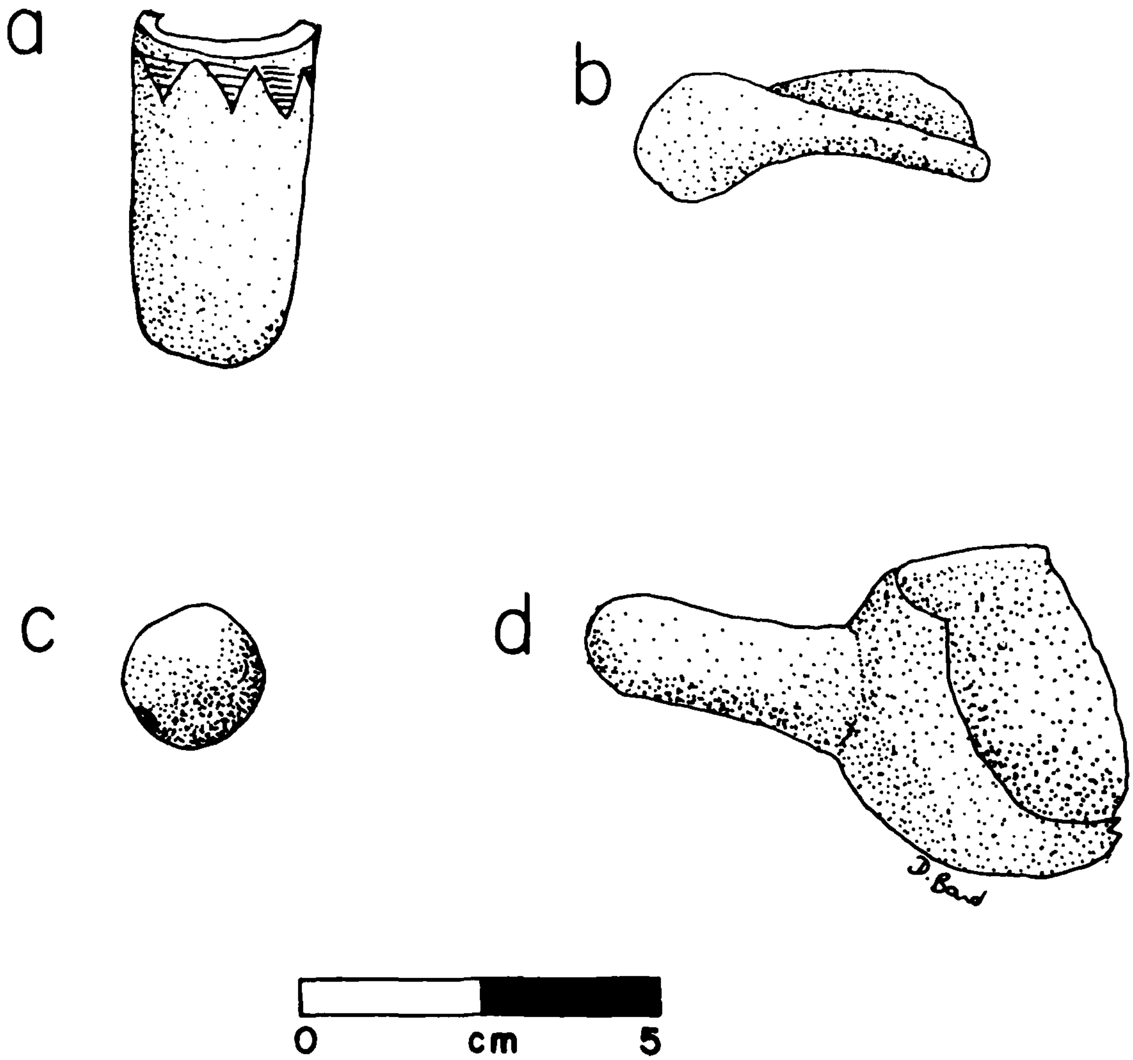


Figure 52. Grog tempered pipe fragments and ceramic objects.

BONE TEMPERED CERAMICS

During the transition from Late Miller II to Early Miller III (500 to 600 A.D.) bone tempered ceramics were manufactured in the Gainesville Lake area. Bone was used sporadically during Miller III in combination with grog. Jenkins (1979a) has established types and varieties for these bone tempered ceramics, and these were applied to the few bone tempered ceramics recognized during this study.

TURKEY PAW PLAIN

Documentation: Jenkins 1979a.

General Description

Turkey Paw Plain ceramics are undecorated bone tempered ceramics. One variety, var. Turkey Paw, has been defined by Jenkins (1979a:232): "It is sorted from other plain surfaced varieties by the presence of a significant amount (5 percent) of crushed bone in the paste." Variety Turkey Paw was represented in the Lubbub Creek collection by two rim and 12 body sherds. The vessel form appeared to be a cylindrical beaker form.

TURKEY PAW FABRIC MARKED

Documentation: Jenkins 1979a.

General Description

Turkey Paw Fabric Marked ceramics are bone tempered ceramics which were decorated with impressions of "fabric wrapped or cord wrapped dowels" (Jenkins 1979a:22). Two varieties were defined by Jenkins (1979a). Variety Gordo was defined as the impression of "several dowels 6 to 12 mm wide, woven together with a simple twined weave" (Jenkins 1979a:229). Variety Turkey Paw was defined as a "single dowel 4 to 5 mm wide, usually applied to the surface in a random manner" (Jenkins 1979a:229). Only var. Turkey Paw was represented in the sample from the Lubbub Creek Archaeological Locality, and this was a single sherd. Vessel form was probably a bowl, but sherd size was too small for identification.

TURKEY PAW CORD MARKED

Documentation: Jenkins 1979a.

General Description

Turkey Paw Cord Marked ceramics are bone tempered ceramics which were decorated with impressions of twined cordage wrapped around paddles. A single variety, var. Moon Lake, has been defined for this type (Jenkins 1979a), and it includes all variations of cord impressed bone tempered ceramics in the central Tombigbee drainage. Variety Moon Lake was represented in the Lubbub Creek collection by five body sherds. The vessel form was probably a bowl form, but identification of specific shape was not possible.

SAND TEMPERED CERAMICS

Sand tempered ceramics are thought to replace the earlier fiber tempered wares in the Tombigbee area sometime between 700 and 300 B.C. Sand tempered ceramics continued to be the major temper group until they were replaced by grog tempered ceramics sometime between 500 and 600 A.D. Jenkins and Walthall (1976) stated that sand tempered Alexander series ceramics were introduced during the late Gulf Formational period and continued to be in use until around 100 B.C. when they were replaced by fabric marked sand tempered ceramics. Jenkins stated that "At approximately 100 B.C., the appearance of fabric marked pottery, and soon thereafter cord marked pottery, most vividly signals the arrival of the Miller culture" (Jenkins 1979a:256). Miller I is defined by Saltillo Fabric Marked and Baldwin Plain as the major types. Furrs Cord Marked made its appearance in Middle Miller I and increased in frequency until it replaced Saltillo Fabric Marked as the dominant decorated type. The point at which Saltillo Fabric Marked began to decline in favor of Furrs Cord Marked in the seriation is where the Miller II phase began. This is a brief overview of the Miller I and II ceramic sequence. For a more detailed account, the reader should refer to Jenkins (1979a:256-263).

ALEXANDER INCISED

Documentation: Haag 1939, 1942; Ford and Quimby 1945; Willey 1949; Heimlich 1952; Wimberly 1960; Phillips 1970; Jenkins 1979a.

General Description

Alexander Incised ceramics are coarse sand tempered ceramics which are decorated on their exterior surfaces with neatly executed rectilinear motifs. The single sherd of Alexander Incised recovered from the Lubbub Creek Archaeological Locality was too small for variety classification or identification of vessel form.

ALEXANDER PINCHED

Documentation: Haag 1939, 1942; Ford and Quimby 1945; Ford, Phillips, and Haag 1955; Heimlich 1952; Wimberly 1960; Phillips 1970; Jenkins 1979a.

General Description

Alexander Pinched is a coarse sand tempered type which is decorated on the exterior surface by either pinching with a fingernail or by impressing with a crescent-shaped tool. Jenkins (1979a:157) described var. Prairie Farms and stated that the "design usually consists of punctated rows or pinched ridges arranged in parallel (rarely haphazard) rows." The outer rim area is often decorated with small round bosses which were applied by pressing a small piece of cane or stick from the interior of the vessel through the wall, causing a small area of deformation on the exterior surface, which was the boss. No complete vessel profiles have been recovered for this variety. Two rim and three body sherds were recovered.

A vessel fragment, with a nearly complete profile, of Alexander Pinched var. Unspecified was also recovered. This sherd, which could be called Alexander Linear Pinched, is shown in Figure 53. The decoration consists of

widely spaced vertical rows of upside down "V's" which were formed by punctations.

BALDWIN PLAIN

Documentation: Jennings 1941; Cotter and Corbett 1951; Koehler 1966.

General Description

Baldwin Plain ceramics are sand tempered undecorated ceramics, which vary mainly in the size of the sand grains used as temper. The coarse sand tempered wares are described as var. Lubbub (Jenkins 1979a). This variety was represented by 4 rim and 56 body sherds at the Lubbub Creek Archaeological Locality. The fine tempered wares are var. Blubber (Jenkins 1979a) and were represented in the collection by 49 rim and 989 body sherds and four podal supports. Variety Baldwin is distinguished by its "right angle excurvate rim" (Jenkins 1979a:165). This rare variety was represented in the collection by 2 rim and 10 body sherds. Jenkins (1979a) suggested beakers, hemispherical bowls, and subglobular bowls as possible vessel forms for this type.

BASIN BAYOU INCISED

Documentation: Willey 1949; Wimberly 1960; Jenkins 1979a.

General Description

Basin Bayou ceramics are fine sand tempered ceramics whose decorations are composed of rectilinear and curvilinear incisions on the exteriors of restricted and hemispherical bowls. A single example of Basin Bayou Incised was recovered, but its variety was indeterminate.

FURRS CORD MARKED

Documentation: Jennings 1941, 1944; Cotter and Corbett 1956; Bohannon 1972; Koehler 1966; Jenkins 1979a.

General Description

Furrs Cord Marked ceramics are fine sand tempered ceramics whose exterior surfaces are decorated by impressions of twisted cordage. This decoration was achieved both by pressing a single cord line into the surface or by wrapping a paddle with cord and compacting the surface with it. In both instances, the impressions were applied over one another. A single variety has been defined for this area, var. Pickens (Jenkins 1979a:179), which includes all varieties of sand tempered cord marking. Variety Pickens was represented in the collection from Lubbub Creek by 27 rim and 648 body sherds. This variety occurred on cylindrical bowl forms.

SALTILLO FABRIC MARKED

Documentation: Jennings 1941; Cotter and Corbett 1951; Cotter 1950; Koehler 1966; Jenkins 1979a.

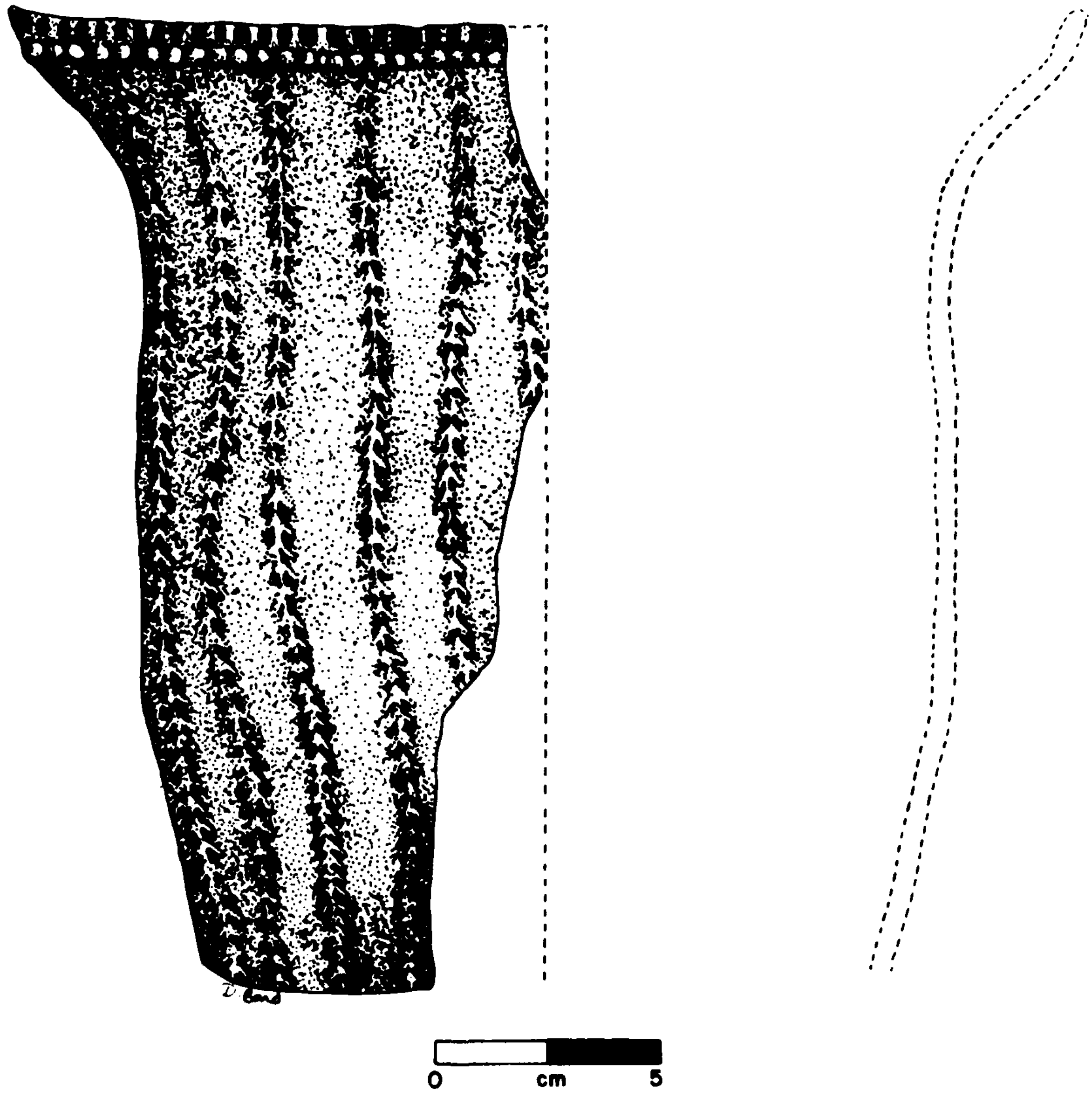


Figure 53. Alexander Pinched var. Unspecified.

General Description

Saltillo Fabric Marked ceramics are sand tempered ceramics whose exterior surfaces are decorated by impressions of cordage which was woven around a single or multiple dowels. Two varieties were defined on the basis of single or multiple dowel impressions. Jenkins (1979a:194) described var. Tombigbee as impressed with several dowels 6 to 12 mm wide, woven together with a simple twisted weave" and var. China Bluff as being "impressed with a single dowel 4 to 6 mm wide, usually applied to the surface in a random manner." Variety Tombigbee was represented in the Lubbub Creek collection by three body sherds, and var. China Bluff by five body sherds.

OTHER SAND TEMPERED CERAMICS

Thirteen unclassified sand tempered incised sherds were recovered from the Lubbub Creek Archaeological Locality. Only one of these sherds, a small bowl fragment, was large enough to distinguish the incised design. The design was an incised ovoid placed below the rim on the exterior of the vessel, with a single punctation in the center of the ovoid.

FIBER TEMPERED CERAMICS

The fiber tempered, Wheeler series ceramics are the earliest ceramics in the area. Jenkins (1979a:252) placed their arrival in the central Tombigbee drainage during the Middle Gulf Formational stage, or Broken Pumpkin Creek phase, which began around 1200 to 1000 B.C. and ended around 500 B.C. with the introduction of the sand tempered Alexander series.

WHEELER PLAIN

Documentation: Sears and Griffin 1952; Haag 1939, 1942; Jenkins 1979a.

General Description

Wheeler Plain ceramics are undecorated fiber tempered ceramics. Two varieties have been established by Jenkins (1979a:241) on the basis of variation in paste composition. Variety Wheeler (Figure 54a-b) is dense fiber tempered with sparse amounts of sand in the paste, while var. Noxubee has a sandy paste with sparse fiber. Variety Wheeler is thought to be the earlier of the two and var. Noxubee was dominant later in the sequence. Seventeen rim sherds, 192 body sherds, and two lug handles of var. Wheeler were recovered from the Lubbub Creek Archaeological Locality. Fourteen body sherds of var. Noxubee were recovered. These varieties appeared to occur on cylindrical beaker forms and simple spherical bowls.

WHEELER PUNCTATE

Documentation: Sears and Griffin 1950; Jenkins 1979a.

General Description

Wheeler Punctate ceramics are fiber tempered ceramics which were decorated on their exterior surfaces with punctations. These punctations were applied either haphazardly over the vessel's surface or in linear

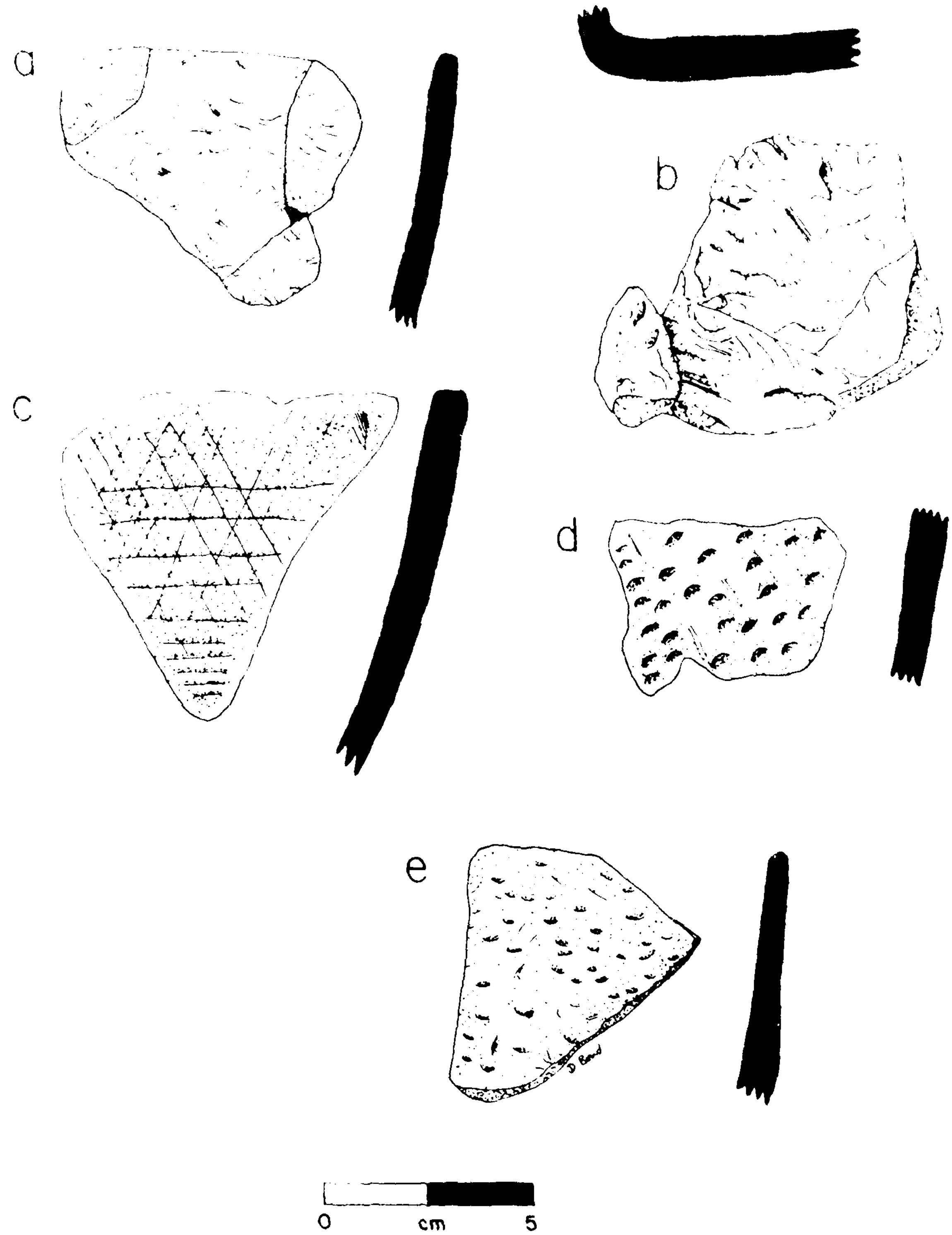


Figure 54. Wheeler ceramics: a-b, Wheeler Plain var. Wheeler; c, Wheeler Simple Stamped var. Owl Creek; d-e, Wheeler Punctate var. Unspecified.

arrangements. Two varieties have been defined (Jenkins 1979a) to account for these variations. In this study, only five body sherds of *var. Panola*, with the linear arrangement, were recovered. The sherds appeared to be from a bowl form, but the specific shape could not be determined.

Eleven sherds of Wheeler Punctate were recovered which did not conform to any established variety for this area. The sherds were decorated with a fingernail or crescent-shaped tool on both the interior and exterior surfaces in a haphazard manner (Figure 54d-e). The paste composition of the sherds was most similar to Wheeler Plain *var. Noxubee*, having a sandy paste with sparse fiber tempering. They appeared to be simple bowl fragments, but the entire profile was not present. Because of the limited number of these sherds, the author has placed them in Wheeler Punctate *var. Unspecified*.

WHEELER SIMPLE STAMPED

Documentation: Sears and Griffin 1950; Jenkins 1979a.

General Description

Wheeler Simple Stamped ceramics are fiber tempered ceramics which were decorated on their exterior surface by impressions of a straight edged tool in the vessel wall (Figure 54c). The impression left a V-shaped trough. These decorations were placed in a haphazard fashion on the vessel's exterior surface, and they have been defined as Wheeler Simple Stamped *var. Owl Creek* (Jenkins 1979a:247). Variety *Owl Creek* was represented by four body sherds in the Lubbub Creek collection. This variety occurred on the cylindrical shaped beaker forms common to the fiber tempered ceramics.

CONCLUSIONS

The general purpose and intent of this research was, first and foremost, a description of the ceramics recovered from the Lubbub Creek Archaeological Locality and a discussion of their relationships to other ceramics described for this and surrounding areas. The most important aspect of this research was the detailed attribute analysis of the Mississippian ceramics. This type of analysis has allowed the author to give not only a general description of the ceramics, but also details of temper, temper size, deliberate surface coloration, surface treatment, condition of the paste when decorations were applied, and line widths of designs. Data on vessel shapes, secondary shape features, handles, and handle metrics was recorded and presented in this paper in minute detail.

The purpose of this accounting was not to establish strict rules of classification to which sherds must be forced to conform, but rather to describe the [illegible] in the ceramics which must be allowed and accounted [illegible] further [illegible] can be made in the realms of the type-variety [illegible].

[illegible] large body of [illegible] presented here for the [illegible] Lubbub Creek Archaeological [illegible] compatible with [illegible] the Southeast and should [illegible] foundation for further research [illegible] comparative research between the Moundville [illegible] Lubbub [illegible] areas such as [illegible]

[illegible] related to that of the Elliot's Creek [illegible] None [illegible] the [illegible] Hemphill Engraved [illegible] ... The [illegible] Moundville [illegible] ... points or circles. On the Elliot's [illegible] ... [illegible] ... formal [illegible] ... [illegible]

[illegible] ... manufacture ... [illegible] ... vessel forms [illegible] ... Thus, it is not unreasonable that the [illegible] identified [illegible] to the other complex-tradition. All of the decorated [illegible] thus far are Carthage Incised var. Moon Lake.

[illegible] Argument for Individual Style in the Context of [illegible] Craft Production at Moundville

The argument for individual style at Moundville (and Snow's Bend) rests upon the recognition of exceptional similarities in the structure and execution of engraved designs on some late Moundville II and Moundville III vessels. All of the vessels involved were Hemphill Engraved. Because the varieties of Hemphill Engraved are defined basically on differences of structure of the engraved design, the varieties provide a convenient and [illegible] defined stylistic context within which to identify sets of vessels by the same hand. To explain briefly, in these materials one looks for (nearly) identical attributes at three levels in the structure of variation of design: [illegible] motif; (2) structural options in rendering motif; (3) technique in execution of motif. In making comparisons it is important to examine equivalent parts of the engraved design on equivalent locations on the same [illegible] form. Comparisons across vessel form are less certain, because [illegible] differences in design may be interpreted either as differences of [illegible] hand or accommodations to difference in decorative [illegible]. [illegible] while comparisons between motifs based upon technique of execution [illegible] are possible they are less certain.

[illegible] vessels with exceptionally similar designs [illegible] of Hemphill Engraved. [illegible] ... [illegible]

in their underlying logics and standardization of products through time. The two technological traditions have different developmental histories. Further, each is closely associated with particular vessel forms and decorative techniques; that is, with specific ceramic types and varieties. I will employ the term "complex-tradition" to refer to the development through time of a logically related set of vessel construction techniques and the vessel forms and decorations most characteristically associated with them. (I apologize for "complex-tradition" but prefer it to terms like "tableware tradition," which suggest function, and to formulations, like "domestic tradition," which imply socio-economic context of manufacture.) The two predominant technological traditions thus provide the basis for defining the hammer-and-anvil finishing complex-tradition and a mold-assisted complex-tradition briefly summarized below.

The Hammer-and-Anvil Finishing Complex-Tradition

This complex-tradition displays a relatively simple history of technique. A stable and efficient technique appears to be developed during Moundville I. In this complex-tradition, vessel form follows from technique, thus vessel forms are relatively limited in number (cooking pots and flaring rimmed bowls) and change comparatively little through time (an alternative bowl form, deeper and somewhat more constricted is added in Moundville III). Vessels belonging to this complex-tradition include unburnished "cooking-pots" with and without incised and modeled decoration (Mississippi Plain and Moundville Incised). The flaring-rimmed bowls are both burnished and unburnished. Some are undecorated, while others have simple designs on the vessel rims (Carthage Incised, particularly var. Moon Lake).

The Mold-Assisted Complex-Tradition

This complex-tradition displays a relatively drawn-out developmental history. It is not until very late Moundville II or Moundville III that an obviously standardized and apparently efficient building technique is achieved. The vessel forms produced within this complex-tradition are not the direct result of a single technique. Rather the whole history of this complex-tradition is one of adapting a variety of techniques to produce a particular desired vessel form. The ceramics most clearly associated with this complex-tradition are characteristically burnished and usually black-surfaced. They include Mississippi Plain var. Hale and Hemphill Engraved var. Hemphill, Elliot's Creek, Maxwell's Crossing, Taylorville, Tuscaloosa, and Wiggins. Typical vessel forms include bottles, pedestalled bowls, and cylindrical bowls. The bottle forms predominate and constitute a complex developmental sequence, beginning with the pedestal based bottles in Moundville I. These early bottles appear to be copies of "exotic" models, which may be tentatively identified with the few Hemphill Engraved var. Elliot's Creek bottles together with one plain bottle of similar technique and form. While this complex-tradition remains highly experimental until the Moundville II/III boundary, a developmental sequence may be discerned. "Rests" become molds as they are used to rotate the vessel, then to hold the shape of the vessel's base, and finally to form the lower part of the body. Successively less of the vessel's body is constructed from coils until in Moundville III the upper half of the bottle's body may also be mold-made. Paralleling this modeling of exotic vessel form, the structure of much of the engraved decoration on the Moundville II and III ceramics seems to be

It seems that, thus, one would achieve a study of the growth of complexity in terms of the pottery-making subsystem. As spinoffs, there would be detailed models of the technology involved, the distribution system involved, and the change of process in a pottery-making subsystem.

A number of other issues could be researched conjointly or at a later date; for example, the relationship between the Mississippian and other cultural centers to the north.

3. Recommendations for a Comparative Stylistic Analysis of Lubbub and Moundville Ceramics: Implications of the Evidence for Distinct Complex-Traditions and Craft Standardization at Moundville

Margaret Ann Hardin

INTRODUCTION

I have examined the ceramics from the initial excavations at Lubbub and the whole vessels from Snow's Bend. I am continuing to work with the Moundville materials for comparative purposes, focusing on the Moundville I materials and on the different developmental histories of the decorative and stylistic attributes associated with the two technological traditions which predominate at Moundville. My comments rest upon the temporal framework provided by Vincas Steponaitis and are informed by discussions with Sander van der Leeuw over the Moundville materials. This report should be read after his, since, in avoiding redundancies, I will not reiterate his arguments about technologies with which I am in agreement except for differences of emphasis in relating the traditions he isolates to each other.

In the report that follows I first discuss the Moundville materials, dealing in turn with the stylistic correlates of the two major technological traditions and with the related problems of individual style and standardized craft production. Second, I turn to the Lubbub ceramics, first commenting on the materials and then making tentative suggestions for relating the Lubbub materials to the two ceramic complex-traditions at Moundville.

MOUNDVILLE

The [illegible] of Two Distinct Complex-Traditions in Moundville Ceramics

Two [illegible] technological traditions predominate in the Moundville [illegible], with hammer-and-anvil finishing tradition and a [illegible] tradition. These two distinctive traditions [illegible] of a single, more generalized tradition, that [illegible]. As might be expected, simple coiling [illegible] to be [illegible] sequence, [illegible] as [illegible]. In contrast, the two more specialized [illegible] techniques. Their beginnings [illegible] some progressively [illegible]

these analyses, it should be taken into account that, theoretically, the structuring which is evident through time in Moundville itself could be equally present through space in the later stages of the development of the system. One would then expect (and therefore have to test for) the existence of zones of varying degrees of complexity around Moundville.

Lastly, it seems improbable that any but a few centers in the direct vicinity of Moundville developed such a structure that the size of the information flow would cause these centers to become 'generating points' of independent manufacturing 'traditions.'

Future Research

We feel we have only uncovered the tip of an iceberg of information on both ceramic manufacturing systems in general and the Moundville system in particular. The Trade-system has not been touched at all. We feel that research in the region as a whole is now vital. The Lubbub project must provide a starting point, so that we can at least compare the complexity in the two centers. Such research at Lubbub, and eventually at other places, could pursue the following sketchy lines:

1. Compilation of a standard coding form using the essential attributes needed to discern the techniques used, the variations observed, and the shapes of the vessels.'

2. Systematic coding of all the vessels for these attributes.

3. Systematic provenience determination for the vessels by means of three steps:

a. mineralogical and element analysis of a sample of pots.

b. scanning for attributes visible with the naked eye or the single lens which covary with provenience.

c. determination of provenience on the basis of these attributes.

4. Spatial and temporal mapping of these products.

5. Definition of the production of the various centers: kinds of products and sizes per product, each defined as a 'technological type' by enumeration of the actions undertaken to construct it.

6. Measuring the amount of information flow (number of observable decisions and non-redundant actions) involved in making the product.

7. Measuring the variability within production centers of the raw materials involved, again as a measure of information flow.

8. Measuring the intra-vessel, intra-product, and inter-product variability of the production of each center for the same purpose.

9. Mapping the information and energy flows (measurable by the number of examples found of each product) for each production center.

specialists. There is a considerably higher degree of skill involved, and a much greater volume of information-processing is required, especially when decoration is added to the vessels. The fact that the pots which were decorated by one and the same individual also seem highly similiar in shape would indicate that there is no horizontal differentiation within the workshops.

Specialization seems to occur at the latest during Moundville II period. One should be aware, however, that whenever really needed, one of the potters in the one tradition could make the pottery of the other, albeit less proficiently. Also, there is the possibility that a number of 'amateurs' stayed around who made pots every now and then. At any rate, a number of less-than-standard pots remain in use.

There is a certain amount of continuity in general technique between the Moundville III products and the later Alabama River Phase products. Not enough material was studied to determine when, or even whether, there is a direct collapse of the information-processing system at the end of the Moundville phase, leading to reduced specialization.

<u>Concluding</u>: At Moundville, pottery-making developed locally and independently, based technologically on the coiling technique. In all probability, there were no specialists at this point in time. The intra-product variability was high, indicating a limited amount of information flow and a low level of organization. Prototypes from a more highly developed 'tradition' of ceramic manufacture were imitated. The original imports and their imitations may be distinguished because the technology involved differs considerably. Imitation required adaptation of the local techniques, leading to the introduction of, among other things, moulds.

Growing production, and the inherently greater information flow, must have led to more standardization, specialization, and organization. The later vessels show a notably lower degree of intra-product variability, while the number of different products grows.

<u>Regional</u>

Indubitably, a higher degree of organization must have distinguished the Moundville pottery manufacture from that of the surrounding region. It is conceivable that the mere existence of this center exercised a structuring influence upon the local manufacture in the region's villages. So far, there seems to be little evidence in that direction. From the regional pottery seen, we must for the moment conclude that the structure of its manufacture remained essentially the same through time and did not rise beyond the level reached at the inception of the Moundville sequence: non-specialized, non-standardized ceramic manufacture.

However, we have only seen an infinitesimal part of the ceramic production of the area during Mississippian times. It is eminently possible that secondary centers developed which have not been identified as yet. The [illegible] which is required in the following phase of the project should devote considerable attention, in our opinion, to the analysis of [illegible] of [illegible] institutions, trade [illegible]

seem to have found an adaptation of both technique and shape to suit the requirements of the local population. Three vessels of presumably "Cadoan" signature are among the possible prototypes.

Sociocultural Implications

It is always dangerous to make any generalizations upon the cursory inspection of a relatively small set of pots, especially when they form a sample (of unknown status) of a much larger population. Nevertheless, it seems important to generate a few hypotheses concerning the potters and their products which may serve as a guide in future research. The following remarks are a purely hypothetical and personal sketch of the development of the pottery-making subsystem in the Moundville area during the Mississippian. They will be divided into two parts, the first sketching the local development at Moundville, the second the effects of this development on the other ceramic manufacturing centers in the area.

Moundville

The ceramic tradition at Moundville may have its roots at a much earlier period than the Mississippian. It is a very simple tradition known all over the southeast, southwest, and adjacent areas and basically consists of coiling. At the time at which the sequence which we have studied starts, the local potters may have had two energy-saving devices included in their 'traditional' baggage: a simple round disc upon which they could rotate the vessels during construction and a hammer-and-anvil set with which they would even out some of the irregularities on their cooking jars. Whether these tools were indeed at their disposal at the beginning of the sequence can only be determined by means of a much more detailed chronological framework. They are included in the materials from what is presently called the earliest phase, together with vessels which have been manufactured without these tools. But techno-'logically' it is probable that the introduction of these tools implies an incipient split in the tradition between the potters making cooking wares and those making tablewares, in which each technique develops its own means of rationalization to cope with the specific requirements of the clays used (the fine wares mainly use untempered, or fine-tempered, malleable clays, and the cooking wares much more tempered, lean, stiffer, and 'dirtier' clay). Needless to say, this 'specialization' does not necessarily imply complete personal specialization: potters could use the two techniques in making the two kinds of pottery. But as the volume of production grows, it would be one of those lines along which specialists would emerge.

At some point both these traditions started developing individually -- the cooking jar tradition in the direction of accelerated production and more standardized shapes (less intra-pot and intra-product variability and possibly a series of more or less standardized sizes). Embellishments were confined to handle-like straps and simple impressed/incised designs.

The 'tableware' tradition, under the influence of imported materials, developed techniques which could cope with the kinds of shapes these imports had. Moreover, through the introduction of the 'rest' and later the mould, and through the use of rat-tail techniques instead of thicker coils, standardization and efficiency were considerably furthered. It seems as if especially this technique was in the hands of (part- or full-time)

All through the period covered by the Moundville materials, these vessels seem to have been made in one and the same basic manner, i.e., by coiling without the use of any support or rest. After thus shaping the pot roughly, the potter would 'iron out' most irregularities by beating it with a paddle, supporting the inside with an anvil. The paddle was flat and smooth, not covered with string or any such substance.

The evidence for this hypothesis comes basically from the surface treatment of all the vessels concerned: faceted surfaces which, after smoothing or polishing, have a 'hammered' appearance. Moreover, the shape of all these vessels is fundamentally similar and, in my experience, similar to such varied hammer-and-anvil made products as the vessels from the Philippines and Nigeria. Typical is the slight contraction above the widest part of the vessel. This amount of contraction, no more and no less, may be created with the proposed system. The uppermost part of the vessels was added as a coil and squeezed out with the thumb on the outside.

It is important to realize that most of the flaring rim bowls were made with this technique. Quite a few of these, undecorated or with very simple decoration, seem to have served as 'moulds' for the complex pottery-making tradition discussed above. Thus, these moulds serve as a means of tying the two traditions together. The same is true of the hand-molded imitations of the complex pottery which occur all through the period of occupation.

<u>Slab-building</u>

Quite separate from the coiling tradition is, at least in conception, the tradition which manufactured the rectangular or part-rectangular vessels in the collection. The technique is one of rolling out slabs of paste, cutting these into the desired shape, and joining them at the edges, then assembling the whole vessel. In some cases, certain surfaces may be constructed out of one and the same slab by bending at right angles, if and only if the clay is coherent enough to support such an action. In the collection, there is one vessel which unites this slab-building technique to the usual Moundville approach. It has a rectangular body build upon a pedestal of the usual size and shape, while the neck is also a cylindrical one. The possibility must be considered that this class of vessels comes from elsewhere, or that some of the examples, coming from other centers, led to local imitations. This would seem to tally with the fact that two of the ovoid pedestalled bottles do not fit in the local manufacturing tradition. In the case of the bottles, such imported ones as these may well have triggered the manufacture of bottles as a whole or of the pedestalled bottles in particular.

<u>Other Vessels</u>

The other pottery will have to be taken into account at a later stage in the analysis. There may be relations between the pottery which has just been discussed and these vessels, notably between the effigy vessels and slab-built materials. This seems to be all the more important because the technology of some of the extraneous objects is markedly different and markedly superior (in the sense of reducing inter-product variability) to that of the locally made materials. It seems in some cases as if imports sparked making similar-looking vessels by means of the local techniques, at least among the high-class (black) ceramics. After some experimenting, the potters at Moundville

7. examples which have been slab built in a saucer. The shoulder of these vessels, however, has been the slab-built in a similar saucer. The potter has joined the two parts after some drying.

The necks of these bottles consist of either one, two, or several coils. In the latter case, these are extremely thin. While building the neck, it was in some cases confined by a strip of leather, bark, or some such material to enable the potter to make it cylindrical (i.e., to obviate the 'splaying-problem'). In other cases, necks were built separately and added after completion. This applies particularly to vessels in categories b5, b6, and b7.

c. <u>on cylindrical bowls</u>:

1. samples which were completely coiled without any aid. They were left very thick and scraped after drying, both inside and outside.

2. examples made on a flat rest. Two coils were added to the slab placed on this rest. They were squeezed out with much care and craftsmanship between the thumb and the fingers, the latter being placed on the outside. These examples are low, so that the fingertips would still be touching the surface on which the potter was working, even after finishing the rim. This provided additional support against 'splaying.'

3. examples made in the same shallow, flat-based bowl as the 'pedestals' mentioned under a3. On the edge of the paste placed in this bowl, the potter would add up to several coils, which were usually very thin whenever the vessel height would exceed the distance between the fingertips and the base of the thumb

d. <u>on semiglobular bowls</u> (of which we have seen but very few examples so far due to biased sampling):

1. examples made without any aids, by using medium thick coils which were squeezed between the fingers with a special movement of the fingers. (This movement, incidentally, was possibly also used for different kinds of coiled vessels, but this has not been checked because we have looked at complete vessels; they are tempered differently -- cf. next paragraph.)

2. possibly one vessel (which is larger than the others) which was made on a slightly convex rotateable surface (bowl?), by means of the coiling technique.

<u>Coiling with hammer-and-anvil finishing</u>

Most, if not all, of the slightly more reddish, round-based, highly tempered 'jars' and the so-called 'flaring rim bowls' seem to have been made in a different manner. Partly, this is undoubtedly due to the fact that the use of the 'jars' -- cooking -- required more and larger-grained temper to absorb thermal shock. The temper must have made the clay considerably leaner than the paste used for the first category of vessels. Hence, it was much less malleable, but on the other hand less liable to sag or collapse during construction.

b. a series of small and less small circular disks cut out of existing vessels;

c. a number of 'flaring rim bowls,' which seem to be moulds rather than bowls, and have a flaring rim to be able to propel them with one hand. The size of these bowls (one of which has not even been finished on the outside, while others have a much more unkempt appearance than the other vessels) varies, as does the height which they reach. In one case, the shape has been adapted to easier handling by leaving room for the fingers between the rim of the bowl and the vessel wall;

d. a number of small circular worn pottery fragments which may have been used as 'scrapers.'

2. The following observations on the material:

a. <u>on globular bowls</u>:

1. examples which have been built up by coiling without any rest at all and have been scraped on the inside and outside

2. examples which have been built up on a small discoidal rest, over which a slab of clay was placed. To this slab, the potters added coils in either of the following ways:

a. vertically on the edge of the slab, thus creating room for the fingers to move between the supporting surface and the vessel wall

b. on the edge of the slab, but sloping outward at the same angle as the slab itself

b. <u>on bottles</u>:

1. examples which have been built up entirely in the coiling system, in one sequence from base through neck to rim

2. examples which have been built up on a small discoidal rest, with the same variability as the bowls (i.e., a2a and a2b)

3. examples which have been built upon a small rest. Along the edge of the slab placed on that rest, the potter would add a few rat-tails and squeeze them tightly together so that a cylindrical buildup could be achieved. About an inch above the base, the pot would be widened, and the angle of the wall is approximately 80 degrees.

4. examples which have been built in a small flat-based bowl, resulting in the same kind of 'pedestal' (cf. a3)

5. examples which have been coiled in a saucer which reaches from the base up to the widest circumference of the pot

6. examples which have been slab-built in a similar saucer, with coiled shoulders (rat-tail or thicker coils)

Coiling also implies squeezing the clay. In some traditions, the coils are shaped into flat bands of clay before adding them to the pot. In the Moundville tradition, such is not the case. The coils are squeezed into shape on the pot as each is added. Squeezing makes the clay move in <u>all</u> directions from under the fingers. As a consequence, simple squeezing would cause the profile of the vessel to splay. The problem may be circumvented in the following ways:

1. Leave the coils thick, let the vessel dry, and scrape the surface in or outside after drying (or somewhere in the middle of that process).

2. Squeeze the coils out against something which may contain the total circumference (such as a mould or a leather strip or piece of string wound around the vessel).

3. Use extremely thin coils which need no squeezing, or

4. Fasten the coils with a special movement of the fingers (cf. van der Leeuw 1976), making sure to add the coil on the inside wherever the vessel stands out and on the outside wherever it bends in.

In the collection, we find evidence among the pottery of this group that the 2nd, 3rd, and 4th of these solutions were used. The following arguments may be presented to argue that the tradition is nevertheless one and the same.

Once the rest is used, the potters must have realized that this rest determined the shape of the base. In some cases, a small, shallow bowl served as a rest. The base was constructed by placing a slab of clay (or even a little ball) into this basin and squeezing it out against the sides. On top of the so-created base, the potter could then begin to build his pot by coiling ('pedestal-base' vessels). Some of the vessels have a low center of gravity and therefore slope outward at quite a considerable angle from the central axis. In order to squeeze rolls at that angle, the potter must have room between the vessel wall and the surface upon which the vessel stands, so that he may move his fingers between the two. This is guaranteed by the 'pedestal'-system. If the potter foregoes that, he must either rest the vessel on a high (kabal-like) rest or shape the lower part of the vessel against something. It is only natural to begin shaping on a somewhat larger dish the shape of the lower vessel (i.e., a mould). Doing that also solves the problem of using fairly thin coils (which is a laborious process) by allowing the potter to use thicker ones. As the size of the mould grows, its limits will be those of the largest circumference of the vessel to be made. The potter will also be able to profit from such moulds by constructing parts of the wall through shaping of either slabs or balls of clay in these moulds. The last step would seem to be that the potter shapes both the lower part of the vessel and the shoulder in a mould and then joins these 'halves' to form the vessel. An orifice may then be cut out.

Which phenomena support this hypothesis?

1. Some of the tools found, notably:

a. a very small circular slightly concave disk which was specially made in this shape;

technological research independent of these categories. They may then be tested against them at a later point in time. Thus, in sketching the development of the pottery-making system at Moundville, I am reasoning from individual vessels observed and not from any kind of existent 'types.'

Essentially, I would like to distinguish three different potmaking 'traditions' in the materials:

1. a coiling tradition which builds its pots upon a 'rest,' i.e., some tool which enables the potter to rotate the vessel fairly easily.

2. a coiling tradition which does not use a 'rest,' but which possibly used the hammer-and-anvil technique to even out the vessel wall after construction or which scraped the wall after manufacture.

3. a slab-building tradition which is responsible for the rectangular vessels.

Numbers 1 through 3 specifically exclude:

4. the miniature vessels which have usually been kneaded out of one lump of clay. These vessels occur together with almost any potmaking tradition except throwing and highly specialized mould-shaping such as occurs in parts of Mesoamerica and the regions adjacent to it. Their manufacture is so uncomplicated that distinguishing traditions in them is well-nigh impossible.

5. those vessels which are shaped in a manner so unlike that of regular pottery containers that they have been made by means of special techniques not usually applied to pottery making (e.g., effigy vessels and the like).

6. a small series of painted and unpainted vessels which are so unlike the majority of vessels that they must be considered extraneous to the area.

These last three categories will be considered at a later date, mainly because their different nature requires a different analysis. The first three traditions will be discussed in the following paragraphs.

<u>Coiling with a 'rest'</u>

Much of the dark colored, polished or smoothed, pottery seems to have been constructed by variants of the major technique observed, i.e., coiling. The variation within this tradition consists, among other things, of the diameter of the coils used, of the nature of the 'rest' upon which the vessel was placed during manufacture, and of the sequence of manufacture.

For better understanding, it is necessary to summarize some of the problems involved in this kind of manufacture. Coiling implies that the potter has to work on all sides of the pot consecutively. If the pot does not turn around lightly, this can only be done either in interrupted movements or single-handedly (unless the potter walks around the pot). If the vessel does rotate with some ease, the force applied to joining the coil to the pot will also propel the pot, so that the potter may work with both hands <u>and</u> uninterruptedly.

for the research at Lubbub Creek. They demonstrated that the intuitive type/variety analysis of the ceramics at that site -- or at Moundville, for that matter -- are sufficient for chronological studies but insufficient for sociological analyses. Moreover, they underscore the problems in the use of traditional concepts, "mode" and "morphological type," for instance, in the analysis of these ceramics. The crucial dimensions of variation seem to be a combination of technical skills and tools <u>and</u> a 'grammar' of decoration. Variation in these dimensions not only sets off the form and function of two major classes of ceramics but defines a developmental trajectory within each class and contrasts ceramic manufacture among social and residential units.

2. Analysis of Moundville Phase Ceramic Technology

S. E. van der Leeuw

The following remarks are a first and a very preliminary summary of one aspect of the findings of Margaret Hardin and myself (i.e., only the technological). A few preliminaries seem necessary:

1. So far, we have not gone through all the material which is pertinent to the problems we are working on. The small amount of Lubbub Creek materials has made it necessary to include the Moundville collection in our search. That proves to be extremely profitable because of the completeness of the collection preserved there. In comparing the two sites, however, there are a few things that need to be taken into account:

a. The materials from Moundville are burial materials and may thus represent only a part of the whole spectrum of ceramic products being used.

b. The Moundville collection comes from a wholly different social and economic system than does the Lubbub Creek material. Because of the highly organized and 'top of the pyramid' aspects of the Moundville site, one must necessarily expect that material from sites 'lower' on the scale may differ considerably.

2. One major aspect of research is lacking so far, notably the investigation of the nature of the raw materials used. On the one hand, this limits our judgment as to the possibilities which this set of raw materials offered from a technological perspective (vitrification range, chemical reactions during firing, cohesiveness and elasticity, drying properties, etc.). On the other hand, we nec rily lack an independent means to distinguish between workshops which may have played a part in providing the city of Moundville and its hinterland with these ceramics. Some of the implications of this lack will become apparent in the appended research design.

3. You will find that I will not express myself in the terms tied to the type/variety system which is common parlance. This has two reasons. First, I am not familiar enough with the system. Second, I would like to conclude the

APPENDIX

1. Introduction

Christopher S. Peebles

> Our discussion has focused on the procurement of widely dispersed raw materials, ceramic manufacture which welds these materials into finished form. The use of ceramics in both primary and secondary contexts, and the refuse-forming behavior which acts as ultimate editor of the archaeological records. It is this latter stage of refuse formation which has been neglected in otherwise splendid and archaeologically useful studies of traditional ceramic crafts available in the general anthropological literature. This neglect has perhaps fostered the occasional optimistic claim that the archaeological record represents a 'fossilized structure of the total cultural system' which produced it. A more reasonable appraisal would be that the archaeological record primarily reflects the behavior which produces refuse. A curious fact about refuse is that while archaeologists obviously seek to discover it, most people...seek to get rid of it (DeBoer and Lathrap 1979:134).

Whether as garbage or as grave goods -- as sherds or as whole vessels -- ceramics do reflect the social and technical aspects of their production, distribution, use, and ultimately, their disposal. As with other classes of artifacts, the task of the archaeologist is to untangle the several natural and cultural forces that determine the final form and context of these items. The two reports in this appendix address the problems of ceramic variability in the Moundville Phase. Each of these reports questions the utility of many time-honored categories and concepts for the analysis of Mississippian ceramics in the Southeast. Each points the way along which the analysis of ceramics from the Lubbub Creek cutoff ought to proceed, and the chapter to which they are an appendix has profited markedly from their suggestions.

The papers by Sander van der Leeuw and Margaret Hardin, which were prepared by them in their capacities as consultants to the Lubbub Creek Archaeological Project, sketch the technological and stylistic developments of the potter's craft at Moundville. They, along with Vincas Steponaitis and Christopher Peebles, believe that the development of two separate technological traditions of ceramic manufacture -- a fine ware made with the aid of a mold and a coarse ware made by coiling -- and the reduction in decorative and morphological variability through time point to specialized ceramic production at Moundville. They then stress the contrasts between the Moundville ceramics, which were made and used in the context of a large ceremonial center, and those at Lubbub, a decidedly provincial town.

Taken as a whole, the analyses reported here have had major implications

thin section analysis, X-ray diffraction, and a host of other analyses dealing with the technologies involved in the construction of the vessels from these related sites.

With this perspective this research should not be looked at as an end but rather as a basis for further research. It is hoped that this analysis has not been entirely a creative activity, but will rather give a better understanding of the ceramics and the individuals who made them.

If technique of vessel construction is used as a temporal indicator the six sets range in time from late Moundville II (clearly defined slab bases) to well into Moundville III (most complete use of molds). Further, the two var. Wiggins sets are clearly late, while the four var. Taylorville sets bridge Moundville II and III. It is worth noting that the most convincing sets are the three latest ones. That is, standardization of engraved design at Moundville occurs precisely during that period of development in the mold-assisted complex-tradition that "efficient" vessel construction techniques are being achieved. The "individual hands" recognized would appear to represent one worker's repetition of the same effective and easily produced design; that is, relatively little effort was being put into decoration.

One pair of var. Taylorville vessels is of particular interest because one member was found at Snow's Bend while the other was found at Moundville. I examined the other whole vessels from Snow's Bend in order to compare them with the pair. Most of the Snow's Bend vessels fell well outside the mold-assisted complex-tradition in vessel form and decoration as well as in clay used. Two vessels from Snow's Bend were constructed from finer clays and resembled the decorated pair in form although not in competence of manufacture. The apparently "local" vessels were hand coiled (perhaps with a rest) and displayed irregularities of form. In contrast, the decorated pair have very thin slab bases and their lower portions were constructed in molds. It does not seem unreasonable to attribute the member of the decorated pair from Snow's Bend to Moundville. Of course, technical analysis is required for a definitive answer.

LUBBUB

Comments on the Lubbub Ceramics Examined

The amount of ceramics from the initial excavations at Lubbub are limited. Correspondingly, my comments should be taken as speculative and tentative. Hopefully they will suggest problems and avenues for their investigation.

The Whole Vessels

The small number of whole vessels and nearly whole vessels I examined appear to represent a rather restricted temporal range, late Moundville I and perhaps early Moundville II. It is noteworthy that these few vessels constitute a good representation of what were the most interesting and elaborate ceramics of their day. Two are pedestalled bottles; both share a "divergent" base form which contrasts with the straight base form more common at Moundville. One is ovoid, paralleling contemporary Moundville bottles. The other is globular, and its form of decoration (Carthage Incised var. Summerville) occurs only on bowls at Moundville. Also noteworthy are the well-made miniature "cooking-pots." One is double and exhibits significant experimentation in design: (1) two designs occur on one pot; and (2) a third on the other. Another miniature of clay atypically fine for a "cooking pot" is exceptionally well made with incised arcs accented by pushing out the vessel's wall. The Bell Plain var. Hall vessel has a rim form not typical of Moundville. With the exception noted, the whole vessel materials fall stylistically within the contemporary Moundville range, although it could well prove fruitful to check systematically for differences in execution of

decoration.

The Limited Representation of the Mold-Assisted Complex-Tradition

Representation of these ceramics in the study collection was limited to four Carthage Incised var. Moon Lake sherds (identified with molds at Moundville) and nine Hemphill Engraved sherds (the products of this complex tradition at Moundville). Six of the Hemphill sherds might be assigned a local provenience on the basis of their greater thickness, chalkier texture, and ivory color (not reduced like Moundville sherds). Of these one was var. Hemphill and exhibited minor problems with the structure of the design. The other five were var. Taylorville: two of them might be considered to exhibit design structure problems. The other three sherds were var. Taylorville, looked like those from Moundville, and exhibited no peculiarities of design structure. It should be noted that degree of surface polish does not appear to co-vary with site.

RECOMMENDATIONS FOR ANALYSIS OF LUBBUB CERAMICS

Lubbub Ceramics in General

At this point the only Moundville complex-tradition that appears to be well represented at Lubbub is the hammer-and-anvil complex-tradition. For this reason I would suggest that a special effort be made to analyze these from both technological and stylistic points of view. The most important technological question would appear to be the relative roles and importance of hammer-and-anvil technique and the ubiquitous simple coiling and pinch pots. The stylistic questions are potentially more elaborate. The analysis should focus on "cooking-pots" as a vessel (Mississippi Plain var. Warrior and Moundville Incised, all varieties) form. Some kind of grammar of decoration (both incised and plastic) should be attempted; even if it is little more than a hierarchy of nominal variables and their co-occurrence rules itself. This should be compared to a comparable statement prepared for Moundville itself. Particular attention should be paid to differences of execution. Potentially fruitful comparisons include: (1) relative flexibility of grammars and variability permitted at the two sites; (2) overlap of content; (3) similarity of co-occurrence rules.

The Mold-Assisted Tradition at Lubbub

Here there are two basic questions. The first involves the Moundville I vintage bottles at Lubbub. Where are they manufactured? The second involves the later Hemphill varieties at Lubbub. To what extent is the manufacture local? Is it less competent in the execution of design, in vessel construction, and in facing? To what extent are Hemphill ceramics produced at Moundville represented at Moundville? In particular are those varieties which contain standardized sets (Taylorville and Wiggins) found at Lubbub? Precisely what portion of the temporal range of the Moundville complex-tradition is represented at Lubbub?

The answers to all of those questions have important implications for assessing the nature of craft specialization at Moundville and Lubbub's relation to Moundville. In this connection, the lack of certain categories of evidence could be of particular importance. Since it is likely that some or

all of the evidence will have to be gleaned from sherds, I would like to conclude by arguing for the feasibility of working with sherds in the absence of whole vessels. If the styles and building techniques used are well-understood, using the Moundville collections as a comparative framework, sherds will provide more technological and stylistic information than normally assumed. The engraved designs are quite redundant and their placement on the vessels is standard, facilitating stylistic comparison. Essential technological information may be contained in a rather small sherd; areas of the vessel which are particularly important are the base, the point of maximum diameter, and the shoulder as it meets the neck.

SUMMARY

In summary I would like to stress that my recommendations for the Lubbub material rest on a very small data base. For this reason I did not suggest more detailed measures and procedures. Also, some of my more specific recommendations may prove to be inappropriate once the materials are more fully known. The basic strategy used to relate the Moundville and Lubbub ceramics remain valid. There are two complex-traditions in the Moundville ceramics. These have separate developmental histories and may well have different social uses and come from differently organized contexts of production. The Lubbub equivalent of each complex-tradition (if it exists) should be systematically examined on its own terms and then compared technologically and stylistically to the equivalent Moundville complex-tradition. The results of this exercise should enhance our interpretation of the two complex-traditions at Moundville and provide a more sensitive assessment of the nature of the relationship between Moundville and Lubbub than a traditional *comparison* of ceramic types.

CHAPTER 2. AN ANALYSIS OF LITHIC MATERIALS FROM THE LUBBUB CREEK ARCHAEOLOGICAL LOCALITY

Aljean W. Allan

An examination of lithic material recovered from any archaeological site affords the analyst innumerable options in the way data are measured and presented. In the following discussion of the lithics from the Lubbub Creek Archaeological Locality, attributes were selected to provide general information about a basic range of lithic phenomena. More intensive analyses and finer measures are left for future scholars.

This chapter begins with definitions of the lithic raw materials used by the prehistoric inhabitants of the Lubbub Creek Archaeological Locality. Next, the modified chipped stone assemblage will be discussed. Included therein will be an extended discussion of the projectile points, especially the small triangular forms associated with the Late Woodland and Mississippian periods. A discussion of the ground and polished stone artifacts follows the chipped stone descriptions, and a presentation of the few metal artifacts concludes the presentation of the data. The final section comprises an examination of the stone artifacts that were found in contexts that have either functional or chronological significance.

The categories used to describe the majority of the lithics are those established by Blaine Ensor (1979). Modifications to his categories here are noted when appropriate. Throughout this chapter, total counts and weights per category encompass all artifacts or items recovered in the Phase I through III excavation units. Any exception to this rule will be noted explicitly.

RAW MATERIAL

Raw materials, the fabric of modified lithics, are considered separately from the actual artifacts for two reasons. First, discussion of the raw materials at this point avoids unnecessary repetition and the necessity of introducing material types each time a new artifact group is described. Second, in some instances pieces of raw material may occur in a context that turns them either into an artifact (e.g., as grave goods) or into a feature (e.g., a collection of pebbles in a pit that have been stored for future use).

The unmodified lithic materials recovered from the 1,138 Phase I test units and 5,593 Phase II and III excavation units were assigned to a descriptive category, counted, and weighed. Only the small, naturally occurring river pebbles were excluded from this enumeration. All other categories such as sandstone, chalk, breccia, and conglomerate were included.

Local versus non-local distinctions between raw materials were made on the basis of visual cues for all materials (see Ensor 1979:4-28). By definition here, non-local material occurs no nearer than 30 miles from the site. Macroscopic examination was the basis for the separation. In the section on projectile points, this subject is discussed more thoroughly.

Chert

The word chert, although geological in origin, carries with it many of the same ambiguities inherent in artifactual terminology. H. Holmes Ellis (1965:1), in an attempt to sort out the flint versus chert controversy, presents at least six schools of thought on the subject. These six are: (1) those who maintain that flint and chert are synonymous; (2) those who understand flint as a chalk formation, chert as pre-chalk; (3) those who claim that flint is a variety of chert; (4) those who consider that chert is an impure flint; (5) those who declare that chert is more pure than flint; and (6) those who simply distinguish between flint, chert, et cetera, on a color basis (Ellis 1965:1). "Et cetera" in this case includes jasper, chalcedony, and a myriad of other terms used to describe naturally occurring crypto-crystalline silicates. In this chapter the term chert, because it is currently the accepted descriptor used in the area under consideration, will be employed to describe all material that is encompassed by this last category. The predominate type of chert that occurs at the Lubbub Creek Archaeological Locality is derived from river deposited gravel of the Tuscaloosa Formation. This chert, frequently referred to in the past as jasper, is usually of a color which ranges from yellow to tan but when heated turns a mottled to dark red (see Ensor 1979 for a synopsis of thermal alteration experiments with this substance). Non-local cherts were also utilized and primarily occur in finished tools. Fine-grained gray chert comprises the bulk of the non-local chert types. Most of this chert probably is derived from the Fort Payne formation from the Middle Tennessee Valley. White chert, which occurs in the coastal plain of Alabama, is the next most frequent type. One worked example of coastal plain agate also was recovered. This type of agate also can be found on the coastal plain, specifically near Coffeeville, Alabama (Dunning 1964:57). Its occurrence is rare in the Gainesville Lake (Ensor 1979).

Quartzite

Ensor (1979:14) describes the locally occurring orthoquartzite. It is found in Tuscaloosa gravels of the Tombigbee Valley but it is more common in the Black Warrior drainage. Tallahatta quartzite was a frequently utilized non-local material. It is coarse-grained mottled white to grayish erosive quartzite which occurs to the south in east central Mississippi and west Central Alabama (Dunning 1964:55). In the central Tombigbee Valley it was used extensively during the Archaic period (Ensor 1979:12).

Petrified Wood

Petrified wood is a material formed by the replacement of wood by silica in such a manner that the original form and structure of the wood is preserved (Gary, McAfee Jr., and Wolf 1974:659). This material occurs locally in terrace deposits (Ensor 1979:17) and can sometimes be conchoidally fractured as evidenced by several flakes and two flaked tools, one uniface, and one

biface, recovered during the Phase II and III excavations. A large piece of unmodified petrified wood was found placed next to the head on the left of a Summerville I or II period burial. A total of 277 pieces of unmodified petrified wood which weighed 2.55 kg was recovered in the Lubbub Creek Archaeological Locality.

Sandstone

Sandstone is a medium-grained clastic sedimentary rock composed of abundant rounded or angular fragments of sand set in a fine-grained matrix such as silt or clay and more or less firmly united by a cementing material, commonly silica, iron oxide, or calcium carbonate (Gary, McAfee Jr., and Wolf 1974:628). Ensor (1979:15-16) reports this material occurs in Pottsville and Hartsville outcrops north and west of the Gainesville Lake as well as in the local terrace deposits. The local material is often referred to as ironstone or ferrigenous sandstone. Sorting criteria for separating local from non-local types have not been clearly established, so no distinctions have been made here. It is likely that the vast majority of sandstone recovered came from local sources. Unmodified sandstone recovered from excavation units weighed 24.53 kg and comprised 8,053 pieces. No attempt was made to plot densities of unmodified materials in occupied and control areas or between areas of differing temporal associations.

Limestone

Limestone, a sedimentary rock consisting chiefly of calcium carbonate, occurs primarily in the form of the mineral calcite. Unmodified limestone, excluding chalk, weighed 303 g and comprised 131 pieces. Chalk, which outcrops locally as Selma and Demopolis chalk, is a soft, pure, earthy, fine-textured, usually white to light gray or buff limestone consisting almost wholly (90-99%) of calcite (Gary, McAfee Jr., and Wolf 1974:407). A total of 379 pieces of chalk which weighed 5.99 kg was recovered from the Lubbub Creek Archaeological Locality. Some of this chalk presumably was used in the production of white pigment.

Conglomerate

Conglomerate is coarse-grained, clastic sedimentary rock; it is composed of rounded to subangular fragments larger than 2 mm in diameter which are set in a fine-grained matrix of sand, silt, or any of the common natural cementing materials (Gary, McAfee Jr., and Wolf 1974:149). Conglomerate occurs north of the Gainesville Lake area in outcrops of the Tuscaloosa Formation and locally in terrace deposits (Ensor 1979:16). Unmodified conglomerate specimens numbered 302 and weighed 1577 grams.

Breccia

Breccia is similar to conglomerate except that [illegible] of the fragments have sharp edges and unworn corners (Gary, McAfee Jr., and Wolf 1974:[illegible]). It has the same distribution as conglomerate in the Gainesville Lake area (Ensor 1979:[illegible]). [illegible] specimens numbered [illegible] and weighed [illegible] grams.

Siltstone

Siltstone is a rock whose composition is intermediate between those of sandstone and shale and of which at least two-thirds is material of silt size (Pettijohn 1957:377). Thirty-five examples of unmodified siltstone which weighed 1.8 kg were recovered from the Lubbub Creek Archaeological Locality.

Hematite

Hematite is the common iron mineral. It occurs in a variety of forms but has a distinctive cherry-red to reddish-brown streak and a characteristic brick-red color when powdered. It is found in igneous, sedimentary, and metamorphic rocks both as a primary constituent and as an alteration product (Gary, McAfee Jr., and Wolf 1974:328). Locally, hematites occur in terrace deposits. Although Jones (1939:11) cites occurrences of this mineral in the Valley and Ridge Province of north central Alabama, it is likely that most, if not all, Lubbub hematite is of local origin. Unmodified pieces of hematite comprised 6,787 pieces which weighed 11.81 kg. One interesting piece of hematite (Figure 10:20) has been worked bifacially into some type of tool.

Limonite

Limonite is a general field term for a group of brown, amorphous, naturally occurring hydrous ferric oxides. It was formerly thought to be a distinct mineral, but now is considered to have a variable composition and may be a mixture of several minerals including hematite (Gary, McAfee Jr., and Wolf 1974:408). Commonly dark or yellowish brown, limonite is sometimes referred to as brown ocher. Both hematite and limonite were sometimes ground for use in pigments. Unmodified limonite was recovered which weighed 2.87 kg and comprised 1,654 pieces.

Steatite

Steatite is a compact, massive, fine-grained, fairly homogenous rock, consisting chiefly of talc but usually containing much other material (Gary, McAfee Jr., and Wolf 1974:690). Often called soapstone, steatite outcrops in the Hillabee schist formation of east central Alabama (Jones 1939:17). The Piedmont of northern Georgia is another source of this material. According to Swanton (1946:546), an historic steatite procurement area was located near Dudleyville, Alabama, in Talapoosa County. Swanton cites Toumey (in the 1858 Second Biennial Report on Geology of Alabama) who reports that no tradition of its use in the manufacture of any objects except pipes has been preserved. Ensor (1979) reports a steatite sherd from site 1 Pi 13 in the Gainesville Reservoir. He points to the fact that this sherd is similar to samples from Soapstone Ridge, south of Atlanta, Georgia (based upon the results of trace element analysis conducted by Luckenback et al 1975).

Greenschist

Greenschist is a schistose metamorphic rock whose green color is due to the abundance of chlorite, epidote, or actinolite present in it (Gary, McAfee Jr., and Wolf 1974:313). Although the term greenstone has a wider application than this particular schistose rock, it has long been accepted as denoting this type of material when referring to aboriginal artifacts, especially

celts. The Hillabee schist formation of east central Alabama is a source location for this material (Jones 1939) as are other localities in the Piedmont (Ensor 1979:17).

Muscovite

Muscovite is a potassium aluminum silicate mineral belonging to the mica group (Daniel, Jr., Neathery, and Simpson 1966:62-63). Muscovite readily splits into very thin, tough, and somewhat elastic plates that have a pearly luster on their surfaces. Muscovite is found in the Piedmont area of Alabama, and Swanton (1946:543) notes mines in Clay County, Alabama. One example, consisting of several small "sheets" of Muscovite, was recovered in a walltrench in one of the structures below the mound.

Copper

Copper is a reddish or salmon-pink isometric mineral, the native metallic element Cu (Gary, McAfee Jr., and Wolf 1974:156).

Galena

Galena is a lead sulfide mineral PbS. It occurs in cubic or octahedral crystals, either in masses or in coarse or fine grains. It has a shiny metallic luster, exhibits cubic cleavage, and is relatively soft and heavy (Gary, McAfee Jr., and Wolf 1974:284). Specimens of galena occur in the Piedmont area of Alabama (Daniel Jr., Neathery, and Simpson 1966). Two cubes of galena were recovered from 10 x 10 m sample units in the Lubbub Creek Archaeological Locality.

UNMODIFIED DISCARDED LITHICS

Before discussing debitage and tool categories, four other subdivisions should be defined for material that may or may not have been modified. Some seemingly unmodified lithics occur in quantities that indicate certain activities such as collection and storage (large cobbles); thermal alteration or accidental heating due to close proximity to intentional fires (fire cracked chert and quartzite, fire cracked rocks); and remains of initial tool reduction stages (large cobbles and cracked cobble fragments).

Waterworn cobbles of chert or quartzite over six centimeters in length were observed in all parts of the site. They were neither counted nor weighed.

Chert and quartzite which showed signs of thermal fracture such as either heat spalls, color or luster change, and irregular breaks comprised 19,203 specimens which weighed 28.97 kg.

Lithic material, excluding chert and quartzite, which evidenced thermal shock in the form of crazing, irregular cracks, or color change comprised 20[illegible] specimens which weighed [illegible]30 grams.

Cobbles of chert or quartzite which were broken or cracked from natural

or aboriginal percussion comprised 3,805 specimens which weighed 26.67 kg These items may be manufacturing shatter from initial reduction sequences, but intentional flaking or platform preparation is not apparent on them.

DEBITAGE AND CORES

Flakes are pieces removed from a parent mass by the application of force (Crabtree 1972:64). Here, we are concerned with the intentional removal of flakes: those flakes exhibiting a platform and bulb of percussion. When flakes show no subsequent modification or use wear, they are classified as debitage. Certain cores, especially exhausted cores, are also a type of debitage because they too comprise a class of discarded material. Cores are defined as a nucleus with flake scars. Flakes and cores, of course, are often subsequently modified into tools. Obviously, one or the other or both become the prototype for finished tools at some point within a given assemblage. The lithic analyst usually presumes most small flakes that have no further evidence of retouch to be aboriginal tool by-products. Cores of an amorphous, broken, or exhausted condition likewise are regarded as by-products. The following debitage and core categories were chosen because they already had been established for sites in the Gainesville Lake (Ensor 1979) and elsewhere. In general, they form a logical sequence of steps in the reduction of cobbles to cores to finished tools.

Primary Decortication Flakes N=1,141.

These are flakes which retained a dorsal surface that was completely covered with natural cortex. These flakes were removed in initial reduction processes. This category of flakes, like all others, excluded those examples which showed macroscopic evidence of utilization. Such flakes were placed instead under the heading utilized flake.

Secondary Decortication Flake N=7,461.

When there was some remnant of cortical material remaining on the dorsal surface of the flake but it covered less than the entire dorsal surface, it was catalogued as a secondary decortication flake.

Thinning Flake N=5,051.

These thin, small flakes possessed flake scars on their dorsal surface and exhibited no cortex on either the dorsal or ventral surfaces; however, cortex might have been present on the striking platform. According to Crabtree (1972:94), these often represent flakes removed from a preform by either pressure or percussion in order to reduce the piece for artifact manufacture. Such flakes also are removed in thinning a biface or uniface and usually display evidence of platform preparation prior to their removal (Crabtree 1972:94)

Amorphous Flake N=637.

Thick, irregular flakes, which did not exhibit a specific shape and platform, and which had no cortex present on any surface, were called amorphous flakes. These are most likely chips resulting during the manufacturing process attributable to shearing or shattering (Ensor 1979:36).

[illegible]

[illegible]

[illegible]

[illegible]

Utilized Flake N=1,[illegible]7.

Any flake without evidence of further intentional modification, but which exhibited macroscopic evidence of edge wear in the form of minute [illegible] flake removal scores in a regular pattern, was classified as a utilized flake. Unfortunately, although use does produce such wear patterns, there [illegible] other factors which might affect the number of "utilized" flakes. There is some evidence, for instance, that the proportion of these flakes may increase in plowzone samples.

Although these various categories of flakes were designed to deal with the reduction sequences of waterworn chert pebbles and cobbles, they do not always adequately reflect progressive manufacturing stages when thermal alteration is involved (Ensor 1979:36). In viewing primary decortication, secondary decortication, and thinning flakes as a sort of A-B-C production series, one assumes the presence of cortex on the entire surface of the parent material. When heat spalling of the raw material occurs prior to reduction, it skews the results of the sequence by presenting facets of unworked surface material minus the original cortex. Ensor (1979:36-37), however, based on his work [illegible] the Gainesville Lake, estimated that about three-fourths of the debitage produced would reflect the by-products of sequential stages of manufacture [illegible] in a classification scheme of this type.

[illegible]

[illegible]

impractical enterprise. Instead, a three-fold division of cores was made: primary, secondary, and blade cores.

Primary Core N=34.

Primary cores are principally cobbles that appear to have been intentionally modified to facilitate the removal of flakes that would be suitable for use as tools or tool blanks. This category excludes blade cores.

Secondary Core N=73.

Secondary cores are similar in all respects to primary cores except that the cobble first has been split or sectioned and these pieces then are modified for use as flake sources. Cores with two or fewer deliberate blade removals are included in this group.

Blade Core N=12.

Cores that have two or more blade removal scars which originate from a prepared platform have been classified as blade cores.

A special case of primary or secondary cobble core is produced through bipolar flaking, the technique of resting core or implement on an anvil and striking it with a percusser. Although no attempt was made to separate bipolar flakes and cores from those of other types, two bipolar core wedges resembling pieces esquilles were recovered during the Phase II and III excavations. According to Ensor (1979:269), bipolar flaking is a distinctive Archaic tradition in the Central Tombigbee Valley. Frequently, this industry is manifested in areas using cobbles as a source material.

FINISHED CHIPPED STONE TOOLS

Technically, utilized flakes, utilized cores, and utilized cracked cobbles were used as tools. When used without further intentional modification, however, they were not catalogued in a uniface or biface category. In contrast, blanks, preforms, and "ceremonial" or funerary artifacts may never have been employed as "tools" in the classic sense, but to be consistent with general lithic reporting methods they were included within this section.

Functional tool nomenclature has a long tradition in lithic analysis even though there is no direct evidence for the "function" of many artifacts. Scrapers, knives, perforators, and so forth were obviously part of the aboriginal tool kit, but the ability to identify them as to their function is often tenuous, especially among those ambiguous categories that occur within certain site assemblages. Even a bifacially worked "drill," as a member of a seemingly clear cut group, might be misidentified. For example, at the Tibee Creek Site, 22Lo600, a "drill" was associated with a burial. It was found at the head of Burial 12 in association with a bone "barrette" and seems to have been a pin used to hold the hair in conjunction with the barrette rather than to drill holes in bone, wood, or shell. If the artifact had not been found in

[illegible]

[illegible] the [illegible] Creek material were adapted from [illegible] when a reasonable fit could be made. [illegible] point might have been designated as [illegible] but this cumbersome method was [illegible] in the interests of terminological parsimony.

[illegible] systems have been perceived as the creations of either "lumpers" or "splitters." Lumpers are criticized for their inability to distinguish between discrete varieties and splitters for excessive segregation. Because of the limited number of lithic tools from the [illegible] locality, particularly those recovered from [illegible] controlled contexts, a "lumper" attitude was adopted for the following tool categories.

PROJECTILE POINTS

[illegible] formed the largest class of flaked tools in the [illegible] [illegible] projectile points are the focus of this [illegible] other flaked stone tool categories are [illegible] following review of the projectile points.

[illegible] Projectile Points (N=277).

[illegible]

consisting of two distinct parts: a distally [illegible] blade, and a [illegible] element usually distinguished from the blade by its assumed prep[illegible] [illegible] by means of edge grinding, [illegible], [illegible]eral [illegible] [illegible] (Ahler 197[illegible]).

In [illegible] [illegible] [illegible] However, [illegible] categories and types were [illegible] [illegible] whole examples to other tool categories so as not to exclude broken specimens.

Projectile points, of all the finished stone tools, provide the most productive material for intensive analysis. Projectile point form is generally thought to display some degree of spatial and temporal diversity and may be of assistance in defining local chronological sequences. For comparative purposes, projectile points are described frequently and illustrated often in archaeological site reports. They are an integral part of almost all tool assemblages, and techniques used in their manufacture are also applied in the production of other tools (Montet-White 1968:51).

Endless permutations are possible in measuring a given artifact, and [illegible] points are no exception. Raw material, manufacturing methods, and [illegible] that reflect the mental template of the maker and the ultimate [illegible] are broad and important considerations. Moreover, these [illegible] are not mutually exclusive and may be interrelated. Several [illegible] in interpreting projectile point data should be presented at this point. [illegible] is to recognize that there are limits to cultural [illegible] diversity as the following claim demonstrates: "[illegible] a small, side-notched, and basically concave arrowhead does not [illegible] any more than owning a Volvo makes you a Swede" (Sheets 19[illegible]:369). [illegible] also evident, despite some investigators' preoccupation with projectile points, that sequences of a limited number of material objects do not create history (Shiner and Shiner 1977:263).

There are difficulties encountered attempting to discern the indefinable boundary between functional and stylistic change (equated with types, classes, categories, etc., of projectile points) and a range of acceptable variation. The latter problem partly results from the nature of lithic reduction sequences. As Deetz (1967:48) has pointed out, errors are somewhat ineradicable in lithic technology because it is a subtractive process. At any point, if a mistake in workmanship occurs, it must be rendered acceptable, or, if rated unsatisfactory, abandoned.

Within the formal category projectile point, there are multiple functional classes of tools. Some classes, defined as formal groups, represent separate functional classes as well (Ahler 1971). Also, the distinct possibility of composite implements exits. In an interesting modern analogy, Bordes (1969:7) describes the pocket contents of ten men as follows: [illegible] knives, two small knives, two screwdrivers, two punches, two small saws, and two can openers. [illegible]'s alternative interpretation is: eight regular pocket knives and two [illegible] knives. Also, as mentioned previously, a point might operate as a different functional tool at different stages in its use [illegible] becomes dull or broken and is subsequently reworked.

[illegible] has been noted that the hafting element of [illegible] points is usually [illegible] with resharpening. [illegible] morphological types [illegible] that originally resembled each other [illegible] in the [illegible] and shape are [illegible] unable [illegible] and [illegible] ceremonial [illegible] might be the only sources of [illegible] forms (Bauer 197[illegible]), at least of stemmed and larger examples.

[illegible] of general issues aside, a selection of attributes for individual projectile points must be made. In this task, it is impossible [illegible] a certain amount of subjectivity in morphological description [illegible] of [illegible] in chipped stone artifacts (Montet-White 1968). Errors [illegible] due to human fallibility on the part of the lithic analyst and [illegible] measuring devices employed during analysis. However, the use of a [illegible] of descriptive attributes insures the consistency of the description. Furthermore, in most cases morphological traits can be expressed through measurement (Montet-White 1968:22).

There is [illegible] universally accepted terminology or standardized attribute [illegible] for the [illegible] of projectile points (Binford 1963). Therefore, of [illegible], one will be established independently for the projectile points [illegible] from the [illegible] Creek Archaeological Locality. The following [illegible] restricted attribute list was employed. It is based on measures [illegible] useful by several analysts.

[illegible] <u>[illegible]ative</u>

Maximum length in millimeters

Maximum width in millimeters

Maximum thickness in millimeters

Basal length in millimeters (stemmed points only)

Basal width in millimeters (stemmed points only)

Basal concavity/excurvature in millimeters

Average proximal shoulder angle (PSA) in degrees (stemmed points only)

Blade edge angle in degrees (Side A)

Blade edge angle in degrees (Side B)

[illegible] A+B [illegible]

[illegible]

[illegible]

[illegible] ... modified into another ... [illegible] ... the stem and the lower portion of the ... [illegible] ... on the other section. This, the ... [illegible] ... light gray ... with pink laminations produced by heat. This point comes from a Phase ... test east of the mound. The three others are made from local material. One of these evidences resharpening. It was found in a Summerville I period structure southwest of the mound. Another, which retains a section of original cortical material was found in a plowzone sample. The fourth point is also from a plowzone sample. The sample statistics for the point types points are: N (unbroken) = 2: Length (mm), mean=45.3, s=1.0; Width (mm), mean=28.[illegible], s=1.1; Thickness (mm), mean=8.6, s=0.2; Basal Length (mm), mean=11.[illegible], s=0.1; Basal Width (mm), mean=16.[illegible], s=1.3; PSA (degrees), mean=95, s=7; Average Blade Edge Angle (degrees), mean=70, s=11; Basal Edge Angle (degrees), mean=[illegible], s=[illegible]; Weight (grams), mean=10.0, s=1.2.

Form 26, Shallow Side-Notched, N=2 (Figure 3:8, 9).

These two side-notched points fall within the description of "Provisional ..." (Cambron and Hulse 1975:132). The two Lubbub examples are remarkably similar in general appearance and were recovered from the same hectare about twenty meters from each other. Both are broad with shallow side notches; both are made from Tallahatta quartzite that is somewhat decomposed. Their cross-sections are biconvex and the flaking pattern appears random. One has a section broken off the blade; the other has a slightly shattered tip. The smaller of the two was recovered in a Miller III pit, the larger, from a nearby plowzone sample. The sample statistics for these two points, which are affected by erosion of the quartzite, are: Length (mm), mean=32.9, s=7.1; Width (mm), mean=9.9, s=1.0; Basal Length (mm), mean=8.8, s=1.5; Basal Width (mm), mean=25.0, s=6.0; PSA (degrees), mean=117, s=15; Average Blade Edge Angle (degrees), mean=82, s=6; Basal Edge Angle (degrees), mean=124, s=79; Weight (grams), mean=6.5, s=2.3.

Form 27, Resharpened Straight Stemmed, N=1 (Figure 3:17).

This specimen has a straight stem, one straight blade edge, and one excurvate blade edge. The flaking pattern is random: large flakes have been removed from the body, and both large and small flakes have been removed unifacially from the blade edges. One of the shoulders is straight and the other is inversely tapered. This tapered shoulder also appears to have been reworked. It exhibits considerable unifacial flake removal. It may have been notched once and the original form could have been a Wade (Cambron and Hulse 1975:122). Made of thermally altered, local material, this point was located in a Phase I test east of the mound. Measures for this example are: Length (mm), 40.0; Width (mm), 30.0; Thickness (mm), 9.1; Basal Length (mm), 7.8; Basal Width (mm), 14.2; PSA (degrees), 92; Average Blade Edge Angle (degrees), 7[illegible]; Basal Edge Angle (degrees), 78; Weight (grams), 7.

Form 28, Resharpened Contracted Stemmed, N=1 (Figure 3:23).

This reworked point, which is made from Tallahatta quartzite, exhibits

Form 23, McIntire-Like, N=2 (Figure 2:34, 35).

Two examples from the Lubbub Creek Archaeological Locality exhibit the general morphological characters of McIntire points (Cambron and Hulse 1975:86). The Lubbub examples are, however, slightly smaller, and one possesses an "unfinished" platform base. Ensor (1979:115) found McIntire and similar points from the Gainesville Lake to have a Late Archaic association. These artifacts display a slightly expanded stem with a straight basal edge, slightly excurvate to straight blade edges and horizontal shoulders. The larger of the two specimens is made of a non-local gray/brown quartzite and has a biconvex cross section. The smaller is made of a thermally altered white chert and has a plano convex cross-section; the flat side appears to be the original flake removal surface from the parent material. One blade of this same point is also beveled, which probably happened during a resharpening effort. The opposite edge is slightly ground or dulled. This point was found in a plowzone sample of a 20 by 10 m excavation unit in the mound area. The quartzite tool came from a plowzone sample southwest of the mound. The sample statistics for these two examples are: Length (mm), mean=40.0, s=4.7; Width (mm), mean=25.1, s=1.3; Thickness (mm), mean=9, s=2.8; Basal Length (mm), mean=8.3, s=1.1; Basal Width (mm), mean=16.5, s=0.2; PSA (degrees), mean=94, s=3; Average Blade Edge Angle (degrees), mean=77, s=12; Basal Edge Angle (degrees), mean=133, s=66; Weight (grams), mean=8.2, s=2.0.

Form 24, Wade-Like, N=4 (Figure 3:2-5).

Four specimens in the collection are similar to Wade points (Cambron and Hulse 1975:122); however, they lack the squarely defined stem that exemplifies the type, and the Lubbub examples do not have pronounced barbs. The stems are straight to slightly rounded, the blade edges are vaguely excurvate, and the cross-sections of these examples are flattened. Of the four, two are made of local material: the complete one from thermally altered, local chert and the other, a proximal section, from a yellow chert. Of the non-local cherts, one is thermally altered white chert, and one, which has a broken tip, is gray, fire-cracked chert. Two are from Phase I tests; one of these is from the section of hectare adjacent to the mound on the west, the other is from east of the mound. The other two are from plowzone excavation units south of the mound. These points, if related to the Wade (Cambron and Hulse 1975), range from Late Archaic to Middle Woodland in age. The sample statistics for these Wade-like points are: N (unbroken) = 2; Length (mm), mean=44.1, s=0.2; Width (mm), mean=32.3, s=1.0; Thickness (mm), mean=7.5, s=0.7; Basal Length (mm), mean=11.8, s=2.0; Basal Width (mm), mean=13.[illegible], s=1.7; PSA (degrees), mean=101, s=1; Average Blade Edge Angle (degrees), mean=68, s=3; Basal Edge Angle (degrees), mean=67, s=13; Weight (grams), mean=8.[illegible], s=0.[illegible].

Form 25, Flint Creek, N=4 (Figure 3:1, 6, 7, 27).

Although these four stemmed points (two of which have been obviously modified since their manufacture) do not exhibit pronounced serrations, they otherwise are morphologically similar in all other respects to the Flint Creek type defined by Cambron and Hulse (1975:51). This type usually, but not always, has a finely serrated blade. The temporal range of this type is Late Archaic to Early Woodland (Cambron and Hulse 1975). According to Ensor (1979:96), the Flint Creek has a long temporal and extensive spatial distribution in the Tennessee and Tombigbee Valleys. The four examples from

rounded shoulders, and is biconvex in cross-section and randomly flaked. This point was found in a plowzone sample west of the mound. This point is similar to Form 21, the Gary type, and probably [illegible] to the Gainesville Middle Woodland Tapered Shoulder cluster (Ensor 1979:149-152). The measures for this point are: Length (mm), 45.5; Width (mm), 20.0; Thickness (mm), [illegible]; Basal Length (mm), 10; Basal Width (mm), 11; PSA (degrees), 75; Average Blade Edge Angle (degrees), 65; Basal Edge Angle (degrees), 97; Weight (grams), 5.[illegible]

Form 21, Gary, N=4 (Figure 2:29-32).

Bell (1958:28) and Cambron and Hulse (1975:57) describe the Gary point as a medium sized contracted stemmed variety with a fairly wide geographic distribution throughout the Southeast. The type's earliest appearance is in the Archaic; however, it has a wide temporal span and could be as late as the Protohistoric in some areas (Bell 1958:28). Jenkins found it to be a dominant Miller I-II period type in the Central Tombigbee area (Jenkins 1975:187), and Ensor (1979:149-152) places similar forms within his Middle Woodland Tapered Shoulder Cluster for the Gainesville Lake. The four examples from Lubbub exhibit the characteristic rounded stem and have straight to excurvate blade edges, tapered shoulders, and a biconvex cross-section. The flaking pattern is random. Three examples are made of local, thermally altered material, and one is made of Tallahatta quartzite. Three are broken: one is a proximal section, one is missing the distal end, and one is shovel incised. Two possess cortical material on one surface. One was recovered from a Phase I test east of the mound and three were recovered from excavations south of the mound, two from plowzone samples, and one from a postmold. The sample statistics for these Gary points are: N (unbroken) = 3; Length (mm), mean=49.4, s=6.1; Width (mm), mean=25.0, s=2.3; Thickness (mm), mean=7.9, s=[illegible]; Basal Length (mm), mean=11.8, s=3.9; Basal Width (mm), mean=14.1, s=1.9; PSA (degrees), mean=81, s=4; Average Blade Edge Angle (degrees), mean=[illegible], s=10; Basal Edge Angle (degrees), mean=109, s=62; Weight (grams), mean=9.2, s=1.1.

Form 22, Bakers Creek-Like, N=1 (Figure 2:33).

The Bakers Creek (DeJarnette, Kurjack, and Cambron 1962:47; Cambron and Hulse 1975:8; Bell 1958:6; Smith 1979:99) is primarily a Tennessee River Valley type found in association with Copena points. Ensor (1979:82-83) found this type in the Gainesville Lake (Class 38 Bakers Creek variety unspecified). However, the basal edge configuration makes its unlikely that the Lubbub specimen is an undisputed Bakers Creek type. The general age of Early to Middle Woodland assigned to the Bakers Creek may be generally applicable since the morphology of the Lubbub example is similar. It is an expanded stemmed, rather thick artifact. The blade is straight, the cross-section biconvex, and the flaking pattern random, with what appears to be indirect percussion flaking on the body and pressure flaking on the edges. The local material is thermally altered and it retains an "unfinished," platform base. This tool was located in a plowzone sample in the area close to and northwest of the mound. The measures for this point are: Length (mm), 52.1; Width (mm), 25.4; Thickness (mm), 10.5; Basal Length (mm), 10; Basal Width (mm), 16.6; PSA (degrees), 102; Average Blade Edge Angle (degrees) 97.5; Basal Edge Angle (degrees), 180; Weight (grams), 13.6.

Angle (degrees), 84; Weight (grams), 10.7.

Form 17, Undesignated Contracted Base, N=1 (Figure 2:24).

This artifact, which has a contracted stem and almost non-existent shoulders, probably has been resharpened several times. Its general thickness and the appearance of step fractures along the blade edge suggest this possibility. This base is similar to Form 28, another obviously resharpened point. In addition, the tip is blunted. It was made from local, thermally altered material, which retained some of the original cortex. It exhibited random flaking and a biconvex cross-section. Probable chronological assignment would be Late Archaic or Woodland. The measures for this artifact are: Length (mm), 49.6; Width (mm), 19.7; Thickness (mm), 8.8; Basal Length (mm), 14.0; Basal Width (mm), 15.0; PSA (degrees), 77; Average Blade Edge Angle (degrees), 90; Basal Edge Angle (degrees), 65; Weight (grams), 7.7.

Form 18, Undesignated "Knobbed" Stem, N=1 (Figure 2:25).

This "knobbed" stem point may be an early Flint Creek variant like those described by DeJarnette, Kurjack, and Cambron (1962:55). If such is the case, it is a late Archaic and Early Woodland type. It possesses a thick, excurvate blade that is blunted at the tip. Shallow shoulders and a thick rounded stem are additional attributes of this specimen. It is biconvex in cross-section and has a random flaking pattern. The material is thermally altered, non-local white chert. It comes from a structure cut and has a mixed Miller III and Mississippian association. The measures for this example are: Length (mm), 45.4; Width (mm), 18.8; Thickness (mm), 11.2; Basal Length (mm). 11.6; Basal Width (mm), 11.7; PSA (degrees), 87; Average Blade Edge Angle (degrees), 93; Basal Edge Angle (degrees), 104; Weight (grams), 8.9.

Form 19, Undesignated "Spike", N=2 (Figure 2:26, 27).

These "spikes" are narrow and weak shouldered. The two examples are both made from non-local material. One, made from thermally altered white chert with a hinge-fractured tip was recovered from the mound test trench. The other, made from dark gray, probably Fort Payne chert which had heavily ground edges, came from a plowzone sample from a 10 x 10 m excavation unit south and slightly west of the mound. Both have biconvex cross-sections and random flaking patterns. They are similar but not nearly so thick as Form 18, the "knobbed" stem described above. The Bradley Spike, a similar point defined by Kneberg (1956:27) and Cambron and Hulse (1975:19), has a Woodland association. The sample statistics for these two projectile points are: Length (mm), mean=44.2, s=6.2; Width (mm), mean=15.8, s=1; Thickness (mm), mean=6.7, s=0.6; Basal Length (mm), mean=9, s=1; Basal Width (mm), mean=11.8; s=0.3; PSA (degrees), mean=97, s=2.1; Average Blade Edge Angle (degrees), mean=84, s=6; Basal Edge Angle (degrees), mean=75, s=8; Weight (grams), mean=5.2, s=1.5.

Form 20, New Market, N=1 (Figure 2:28).

This rounded, stemmed point fits within the range of the New Market type defined by Cambron and Hulse (1975:96). They assign it to the Woodland and later periods in Alabama and note that it is found in association with Swan Lake, Flint River Spike, and Bradley Spike points. The Lubbub example is made from local yellow chert, has straight blades, is slightly asymmetrical, has

Form 13. Undesignated Expanded Stemmed, N=1 (Figure 2:13).

A proximal section of a thick expanded stemmed point made of gray chert, probably from the Fort Payne Formation, was recovered south of the mound. This example is characterized further by slightly tapering shoulders, a biconvex cross-section, and an "unfinished" or platform base. An impurity in the material appears to have caused the break. Although there is no common type name for this point, in this context it is, plausibly, a Woodland point, one similar to the Swan Lake type. The measures for this point are: Width (mm), 18.5; Thickness (mm), 9.3; Basal Length (mm), 13.7; PSA (degrees), 109; Average Blade Edge Angle (degrees), 82; Basal Edge Angle (degrees), 180.

Form 14. Undesignated Large with Round Base, N=1 (Figure 2:21).

A single large point, which had a rounded base and which was manufactured from non-local, thermally altered white chert, was recovered from a daub concentration in excavations south of the mound. In addition to its rounded base and rounded shoulders, the blades exhibited minimal excurvature. Random percussion flaking is evident, but the edges were pressure flaked. The cross-section is biconvex. This point does not conform to any common type name but it is similar to Cotaco Creek points and thereby is probably Late Archaic or Woodland in age. The stem edge and distal tip both are broken slightly. The measures for this artifact are: Length (mm), 54.6; Width (mm), 35.7; Thickness (mm), 12.2; Basal Length (mm), 11; Basal Width (mm), 17.6; PSA (degrees), 102; Average Blade Edge Angle (degrees), 69; Basal Edge Angle (degrees), 97; Weight (grams), 21.9.

Form 15. Cotaco Creek, N=1 (Figure 2:22).

As a large, straight-stemmed, rounded shouldered point, this specimen comes within the range of the Cotaco Creek type (Cambron and Hulse, 1975:33; DeJarnette, Kurjack, and Cambron 1962:53). The cross-section is flattened, the body appears to have been reduced by percussion flaking, and the edges exhibit pressure retouch. The fabric of the point is local, thermally altered chert. This point comes from a plowzone sample taken from an excavation unit southwest of the mound. The chronological range of this type extends from the Archaic to the Woodland in Alabama (Cambron and Hulse 1975:33). The measures for this example are: Length (mm), 53.9; Width (mm), 38.7; Thickness (mm), 12.6; Basal Length (mm), 10.0; Basal Width (mm), 17.0; PSA (degrees), 78; Average Blade Edge Angle (degrees), 67; Basal Edge Angle (degrees), 80; Weight (grams) 19.1

Form 16. Big Slough, N=1 (Figure 2:23).

This Big Slough point is made from thermally altered, local chert. It is [illegible] blade edges, an expanded stem, and slightly barbed [illegible] convex. The base [illegible] sample from an [illegible]

mean=31.2, s=0.7; Width (mm), mean=17.3, s=3.5; Thickness (mm), mean=7.4, s=0.8; Basal Length (mm), mean=6.0, s=1.4; Basal Width (mm), mean=10.3, s=1.6; PSA (degrees), mean=89, s=21; Average Blade Edge Angle (degrees), mean=75, s=11; Basal Edge Angle (degrees), mean=73, s=10; Weight (grams), mean=3.4, s=1.2.

Form 10, Undesignated Small Stemmed, N=2 (Figure 2:17, 18).

Two examples of crudely flaked small stemmed points were recovered, one from an excavation plowzone sample and one from a postmold. These points are manufactured of local, thermally altered material. Biconvex cross-sections, random flaking, slightly contracting bases, and tapering shoulders characterize these points. One specimen has a broken tip and one has an "unfinished" or striking platform base. Sample statistics for these two points are: Length (mm), mean=30.0, s=2.9; Width (mm), mean=20.0, s=7; Basal Length (mm), mean=7, s=0.6; Basal Width (mm), mean=5.9, s=1.5; Thickness (mm), mean=9.5, s=0.7; PSA (degrees), mean=98, s=11; Average Blade Edge Angle (degrees), mean=83, s=9; Basal Edge Angle (degrees), mean=121, s=83; Weight (grams), mean=2.5, s=0.6.

Form 11, Collins, N=2 (Figure 2:19-20).

Two broken proximal sections, made from local, thermally altered chert, fall within the range of these designated Collins in the lower Mississippi Valley (Brain 1972:62; Collins 1932). It appears to be a Late Woodland-Early Mississippian artifact in the Gainesville Lake (Ensor 1979:80). These points have expanded bases and horizontal shoulders. They are thin, flattened in cross section, and exhibit random flaking. One of these two projectile points was found in a Phase I test unit east of the mound; the other was found plowzone sample approximately 200 meters south of the mound. Sample statistics for these two points are: Length (broken); Width (mm), mean=21.0, s=7.6; Thickness (mm), mean=4.1, s=1.2; Basal Length (mm), mean=7.0, s=1.4; Basal Width (mm), mean=12.4, s=1.3; PSA (degrees), mean=110, s=2; Average Blade Edge Angle (degrees), mean=55, s=10; Basal Edge Angle (degrees), mean=55, s=1; Weight (grams) mean=1.4, s=0.7.

Form 12, Swan Lake, N=1 (Figure 2:12).

The single Swan Lake point recovered from the Lubbub Creek Archaeological Locality is a small, shallow side-notched, randomly flaked point made of a non-local gray chert, probably from the Fort Payne Formation. The cross-section is biconvex and the base is an "unfinished," striking platform type. This description fits that given by Cambron and Hulse (1975:120) for the Swan Lake points which occur first in the Archaic and which reach their greatest abundance during the Woodland period in Alabama. Swan Lake points are similar to the Archaic Lamoka point described by Ritchie (1961:29). The Lubbub example was recovered from a Phase I test pit east of the mound. Measures for this specimen are: Length (mm), 34.7; Width (mm), 17.0; Thickness (mm), 5.4; Basal Length (mm), 4.5; Basal Width (mm), 11.9; PSA (degrees), 119; Average Blade Edge Angle (degrees), 60; Basal Edge Angle (degrees), 180; Weight (grams), 3.4.

plowzone sample west and slightly south of the mound area. Projectile points of this type occur generally in Late Woodland to Mississippian components in Alabama (Cambron and Hulse 1975). This example from the Lubbub Archaeological Locality has the following measurements: Length (mm), 27; Width (mm), 17.7; Thickness (mm), 4.4; Average Blade Edge Angle (degrees), 77; Basal Edge Angle (Degrees), 61; Weight (grams), 1.5.

Form 7, Nodena, N=1 (Figure 2:8).

A willow-leaf shaped point manufactured from a thin flake, the Nodena (Bell 1958:64-65; Cambron and Hulse 1975:97) is named after the Nodena Site in eastern Arkansas. Chronological associations suggest it is a late prehistoric type (Bell 1958:64). The Lubbub point possesses a flattened cross-section and broad, shallow, random flaking. It was recovered during Phase I in a unit about three hundred meters east of the mound. Measures for this point are: Length (mm), 30.2; Width (mm), 9.2; Thickness (mm), 2.0; Average Blade Edge Angle (degrees), 52; Basal Edge Angle (degrees), 33; Weight (grams), 0.4.

Form 8, Guntersville-like, N=3 (Figure 2:9-11).

Three examples, made of thermally altered, local material, parallel the description for Guntersville points (Cambron and Hulse 1975:62), except they appear to be a more diminutive version. Similar points are included by Kneberg (1956:55) in the Late Mississippi triangular cluster. Two of these specimens were recovered from Phase I tests east of the mound and outside of the areas excavated during Phases II and III. One with a distal end modified, possibly for use as a "perforator," was recovered from a Miller III pit. A Woodland to Late Mississippian association has been proposed for these points in Alabama (Cambron and Hulse 1975:62), although they may occur later in Tennessee (Kneberg 1956:85). In both cases, they do occur in association with Madison points. These points have slightly excurvate blades, relatively straight bases, a flattened to biconvex cross-section, a random flaking pattern, and appear to be made on flakes. Sample statistics for these projectile points are: N (unbroken) = 3; Length (mm), mean=27.0, s=2.1; Width (mm), mean=13.1, s=3.5; Thickness (mm), mean=4.1, s=0.9; Basal Concavity (mm), mean=0.2, s=0.4; Average Blade Edge Angle (degrees), mean=61, s=14; Basal Edge Angle (degrees), mean=57, s=13; Weight (grams), mean=1.2, s=0.6.

STEMMED POINTS

Form 9, Coosa, N=2 (Figure 2:15, 16).

Small, thick points with short stems such as two Lubbub examples resemble the Coosa Point (DeJarnette, Kurjack, and Keel 1973:179; Cambron and Hulse 1975:29). Cambron and Hulse suggest a Middle Woodland association for these points in Alabama. Both examples from the Lubbub [illegible], were recovered from Miller [illegible]. Both examples appear [illegible] thermally altered chert [illegible] the Fort Payne Formation. The blades [illegible] the [illegible] ... The single specimen made from [illegible]

The catch-all category, undesignated small triangular, includes all those small triangular types that do not fit either the Madison or the Hamilton categories. Like those two named types, they also possess three vertices, random flaking patterns, and flattened cross-sections. Their morphological characteristics differ from Hamilton and Madison points in edge shape and size. Their similarities, however, suggest they are a related type. Of the 17 small triangular points, 12 are made from local, thermally altered chert, 4 from local, unaltered chert, and 1 from non-local, thermally altered chert. Sample statistics for these projectile points are: N (unbroken) = 11; Length (mm), mean=23.7, s=4.8; Width (mm), mean=14.3, s=2.8; Thickness (mm), mean=5.3, s=0.9; Basal Concavity (mm), mean=0.2, s=1.4; Average Blade Edge Angle (degrees), mean=75, s=16; Basal Edge Angle (degrees), mean=71, s=14; Weight (grams), mean=1.4, s=0.7.

Form 4, Large Triangular, N=4 (Figure 2:1, 2).

Large triangular points fall within the description of the "Provisional" type defined by Cambron and Hulse (1975:133). They possess three vertices, have straight to slightly excurvate blades, and straight to minimally excurvate bases. Three of the four specimens, two of which are proximal sections, are made of local, thermally altered material. One is made of non-local, Tallahatta quartzite. Their cross-sections are flattened and they exhibit a random flaking pattern. Minute blade retouch suggests they may have served as cutting implements. Three are from Phase I tests east of the mound; the fourth was recovered from a plowzone sample south of the mound. This generalized type has a wide chronological range that begins in the Late Archaic and continues through the Mississippian period. Sample statistics for these points are: N (unbroken) = 4; Length (mm), mean=30.9, s=3.1; Width (mm), mean 26.9, s=9.0; Thickness (mm), mean=6.7, s=1.5; Average Blade Edge Angle (degrees), mean=60, s=10; Basal Edge Angle (degrees), mean=65.0, s=1; Weight (grams), mean=6.4, s=4.2.

Form 5, Trianguloid-Rounded Base, N=2 (Figure 2:3, 4).

These two projectile points have slightly excurvate sides and a rounded base. One is made of a fossiliferous gray chert which probably came from the Bangor formation; the other, a proximal section, is made from local, thermally altered material. The cross-section is biconvex and the flaking pattern random. These two artifacts were recovered from plowzone samples in neighboring hectares south of the mound. This type probably has a temporal range from Middle Woodland through Mississippian. The measures for the complete specimen are as follows: Length (mm), 30.8; Width (mm) 14.5; Thickness (mm) 7.3; Average Blade Edge Angle (degrees) 87; Basal Edge Angle (Degrees), 75; Weight (grams) 3.0.

Form 6, Jack's Reef Pentagonal, N=1 (Figure 2:5).

This pentagonal shaped point falls within the range of the Jack's Reef Pentagonal point (Ritchie 1961:28; Cambron and Hulse 1975:69). The type has been locally referred to as "Mississippi Pentagonal" (Cambron and Hulse 1975:69). Made of local, thermally altered material, the Lubbub specimen exhibits a random flaking pattern and a flattened cross-section. It appears to have been made on a flake. Heavy unifacial retouching on the distal tip suggests that this point was resharpened. This example was found in a

STEMLESS PROJECTILE POINTS

Form 1, Madison, N=103 ([illegible] Figure 4).

The Madison [illegible] 195[illegible]; Cambron and Hulse [illegible]:84) was first described by Scully (1951:14) as the Mississippian Triangular but [illegible] name was [illegible] to Madison [illegible] Madison County [illegible] [illegible] type of the late Mississippian [illegible] Tennessee [illegible] this point was the most numerous type found in the [illegible] Creek Archaeological Locality.

Random flaking with [illegible] and a flattened cross-section characterize these small triangular artifacts. Their blades are straight to slightly excurvate and their base is either straight or slightly incurvate. Of the 103 Madisons in the collection, 79 are from the Phase II and III excavations and 24 are from the Phase I tests. There are 67 whole or minimally broken points, 35 proximal sections, and one distal fragment; 15 are made from local, unaltered chert, 57 from local, thermally altered chert, 5 from non-local, unaltered chert, and 2 from non-local, thermally altered chert. Two of these points have been reworked on their distal ends. Although this type has a wide distribution as a Mississippian form (Scully 1951:14; Perino 1968:52; Cambron and Hulse 1975:84), Jenkins (1975:191) has also established that it occurs in the Miller III period within the Central Tombigbee Valley. Sample statistics for these projectile points are: N (unbroken) = 67; Length (mm), mean=22.4, s=6.3; Width (mm), mean=14.0, s=2.7; Thickness (mm), mean=4.2, s=0.9; Basal Concavity (mm), mean=0.4, s=0.6; Average Blade Edge Angle (degrees), mean=70, s=12; Basal Edge Angle (degrees), mean=67, s=20; Weight (grams), mean=1.1, s=0.5.

Form 2, Hamilton, N=19 (Figure 4).

Hamilton points (Bell 1970:54; Cambron and Hulse 1975:64; DeJarnette, Kurjack, and Cambron 1962:57) also are referred to as the Hamilton Incurvate (Kneberg 1956:85). This type, according to Kneberg (1956:85), is a Late Woodland type. In eastern Tennessee, it is associated with the Hamilton burial mound culture. These small, triangular points have incurvate blades, and, although a few examples have been noted with straight bases (Cambron and Hulse 1975:64), the majority of the bases are incurvate. For the sake of clarity here, the Hamiltons will be distinguished from Madisons -- and from other small triangular points -- by the possession of three incurvate edges. These points differ also from Kneberg's (1965:85) classic definition in that, although all have finely pressure chipped edges, in some cases the body is crudely flaked. The flaking pattern is random and the cross-section, flattened. In Phase I tests, 3 Hamiltons were recovered (one from an area adjacent to and east of the mound), and 16 were derived from Phase II and III excavation contexts. Of this number, 7 were whole or minimally broken, and 12 were proximal sections. Local material was used in all 19 Hamiltons, and 12 were heat treated. Sample statistics for these projectile points are: N (unbroken) = 7; Length (mm), mean=22.3, s=4.0; Width (mm), mean=14.5, s=2.5; Thickness (mm), mean=4.5, s=1.1; Basal Concavity (mm), mean=1.3, s=0.3; Average Blade Edge Angle (degrees), mean=73, s=11; Basal Edge Angle (degrees), mean=67, s=9; Weight (grams), mean=1.0, s=0.4.

Form 3, Undesignated Small Triangular, N=17 (Figure 4).

TABLE 2

(Continued)

Form #	Type-Name	Number of Specimens	General Temporal Range
19	Undesignated "Spike"	2	Woodland
20	New Market	1	Woodland to Protohistoric
21	Gary	4	Archaic to Protohistoric (Central Tombigbee, Miller I-II)
22	Bakers Creek-like	1	Middle Woodland
23	McIntire-like	2	Late Archaic
24	Wade-like	4	Late Archaic to Middle Woodland
25	Flint Creek	4	Late Archaic to Early Woodland
26	Shallow Side-Notch	2	
27	Resharpened Straight Stem	1	Late Archaic to Middle Woodland
28	Resharpened Contracting Stem	1	Late Archaic
29	Indeterminate Stemmed	9	
30	Point as modified tools	9	
31	Indeterminate fragments	69	

TABLE 2

Summary and Chronological Range of Projectile Points Recovered from Lubbub Creek Archaeological [illegible]

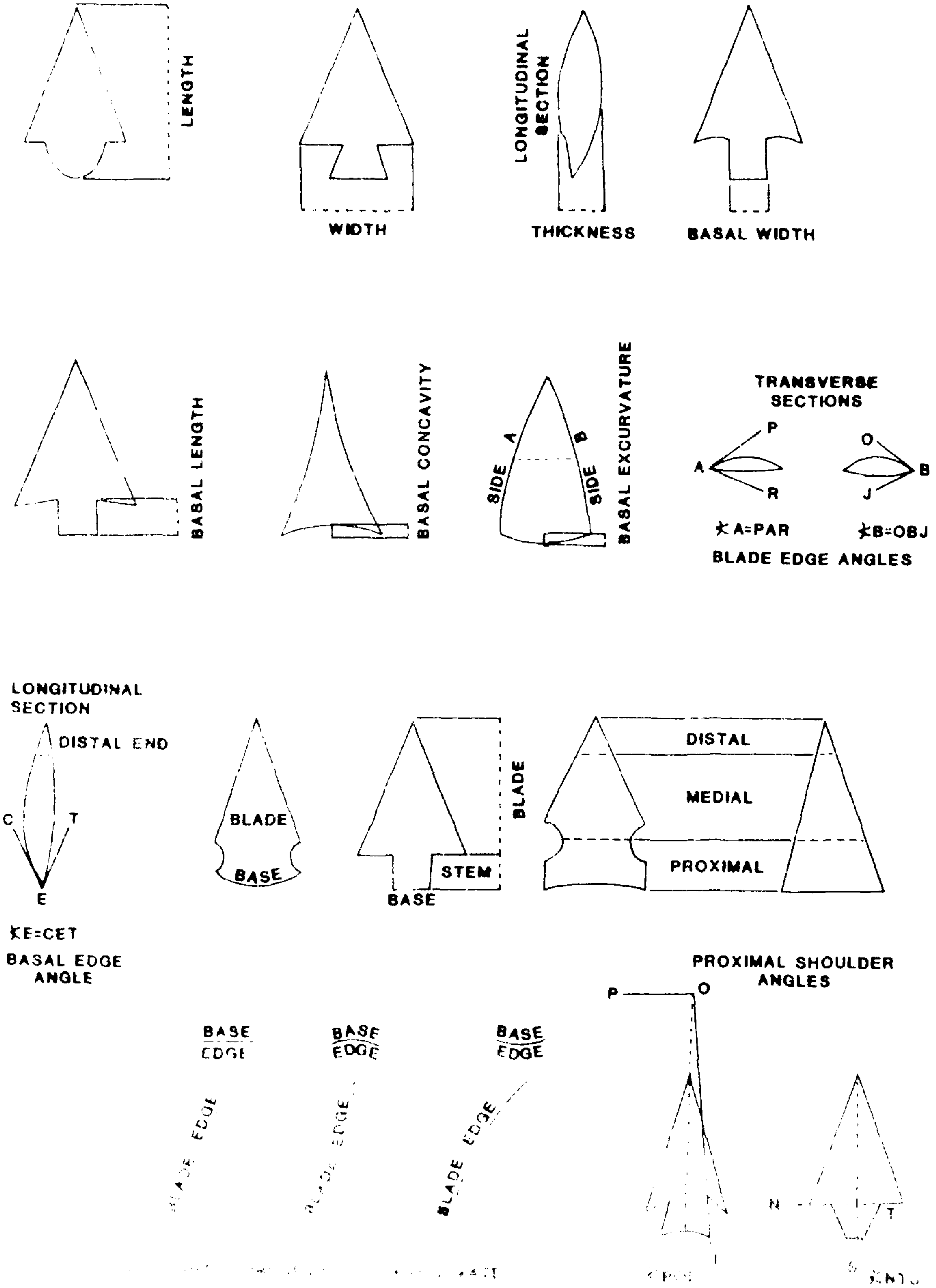
Form #	Type Name	Number of Specimens	General Temporal Range
1	Madison	[illegible]	Late Woodland-Mississippian [illegible]
2	Hamilton	19	Late Woodland
3	Undesignated Small Triangular	17	Late Woodland to Protohistoric
4	Large Triangular	4	Late Archaic to Protohistoric
5	Triangular Round Base	2	Late Woodland and Mississippian
6	Jack's Reef Pentagonal	1	Late Woodland [illegible] Mississippian
7	Nodena	1	Protohistoric
8	Guntersville-like	3	Woodland to Late Mississippian
9	Ocona	2	Middle Woodland
[illegible]	Undesignated Small Stem	2	
11	Collins	2	Late Woodland and Early Mississippian
12	Swan Lake	1	Archaic and Woodland
13	Undesignated Expanding Stem	1	
14	Undesignated Large Round Base	1	Late Archaic and Woodland
15	Cotaco Creek	1	Archaic and Woodland
16	Big Slough	1	Early and Middle Archaic
17	Undesignated Contracting Base	1	
18	Undesignated "Knob" Stem	1	Late Archaic and [illegible]

TABLE 1

General Attributes and Measures for Projectile Points.

Author(s)	Projectile Point Designation	Length	Width	Thickness	Description of Haft Element	Description of Blade	Material	Weight
Ahler (1971)	Category	X	X	X	X	X	X	
Binford[2] (1963)		X	X	X	X	X		
Bell & Perino[1] (1958, 1960, 1968, 1971)	Type Name	X	X	X	X	X		
Cambron & Hulse[1] (1975)	Type Name	X	X	X	X	X	X	
Ensor (1979)	Class	X	X	X	X	X	X	
Faulkner & McCollough (1973)	Number	X	X	X	X	X	X	
Futato[2] (1977)	Class	X	X	X	X	X	X	X
Goodyear (1974)	Type Name	X	X	X	X	X		
Jenkins & Nielsen (1974)	Type Name	X	X	X	X		X	
Montet-White (1968)	Type Name	X	X		X	X		
Price & Griffen (1979)	Type Number	X	X	X	X	X		
Ritchie[1] (1971)	Type Name	X	X	X	X	X		

[1]Regional guide.
[2]Typological guide.


LENGTH
WIDTH
LONGITUDINAL SECTION
THICKNESS
BASAL WIDTH
BASAL LENGTH
BASAL CONCAVITY
SIDE A
SIDE B
BASAL EXCURVATURE
TRANSVERSE SECTIONS
P
A
R
O
B
J
∢A=PAR
∢B=OBJ
BLADE EDGE ANGLES
LONGITUDINAL SECTION
DISTAL END
C
T
E
∢E=CET
BASAL EDGE ANGLE
BLADE
BASE
STEM
BASE
BLADE
DISTAL
MEDIAL
PROXIMAL
PROXIMAL SHOULDER ANGLES
P
O
N
T
BASE EDGE
BASE EDGE
BASE EDGE
BLADE EDGE
BLADE EDGE
BLADE EDGE

Material: local/non-local

Thermally altered (red coloration present): yes/no

Broken: no/proximal/distal/medial (medial designation used only when no evidence of proximal or distal section is present)

Blade edge shape (Side A): straight/incurvate/excurvate/other

Blade edge shape (Side B): straight/incurvate/excurvate/other

Basal edge shape (non-stemmed points only): straight/incurvate/excurvate/other

Although there are few direct interpretations of a technological nature incorporated in this list (i.e., flaking patterns, basal thinning, beveling, etc.), the blade and base angle measurements and thickness combined with the other recorded dimensions are a function of manufacturing methods. As previously mentioned, other variables not on the list will be noted when appropriate. Formal statistical analysis was employed as an aid to the definition of Lubbub projectile point categories, but it was not the sole source of their derivation. The system used here should provide enough data for ready comparison and integration with other classification schemes for projectile points.

The usefulness of any artifactual analysis to other archaeologists is based on its descriptive nature and its ability to be equated with other assemblages. The following review (Table 1) represents a diverse group of publications which were selected only to exemplify the use of certain measures on an inter- and intra-regional level. It must be recognized that the aims of these endeavors were circumscribed by their research designs, time, funds, and interest of the authors. This is by no means an exhaustive list of attributes considered by these individual investigators.

Since a great deal of controversy has gone into discussing the typological concept, an attempt to review the literature will not be attempted here. Most archaeologists do agree, however, given a collection of artifactual materials, some system of placing elements into groups must be undertaken to facilitate analysis of the data. In order to isolate these groups, certain variables must be given precedence over others.

For the collection of projectile points from the Lubbub Creek Archaeological Locality, the traditional type-name system such as that employed by Cambron and Hulse (1975) was used to place points into categories. Admittedly, this method has considerable limitations because the trait-list-name system often obscures important variability within types. The combination of typological categories and statistical measures of the projectile points within any type should go a long way toward solving this problem. Table 2 lists the points by the heading "form" followed by a number. A name was applied where appropriate and a definition of the type given. To be consistent with past point type descriptions in the area much of the formal terminology utilized by Cambron and Hulse (1975) in The Handbook of Alabama Archaeology was employed.

numerous step fractures along both blade edges as evidence of probable resharpening activity. It possesses slightly incurvate blades, minimal shoulders, and a contracted, straight-based stem. The general configuration suggests the point may originally have been a McIntire (Cambron and Hulse 1975:86) or similar point. The cross-section of this artifact is biconvex and the flaking pattern is random. It was recovered from a Phase I test approximately 300 meters south and slightly east of the mound area. The measures for this item are: Length (mm), 41.2; Width (mm), 22.7; Thickness (mm), 10.4; Basal Length (mm), 11.3; Basal Width (mm), 16.0; PSA (degrees), 81; Average Blade Edge Angle (degrees), 79; Basal Edge Angle (degrees), 86; Weight (grams), 7.1.

Form 29, Indeterminate Stemmed, N=9 (Figure 2:14, 3:10-16).

These are specimens which are broken in such a manner as to render identification, beyond the recognition of stems, difficult. An attribute list for these points, which scores only the attributes which are present, can be found in Table 3. This category does not include examples in Form 30, reworked points.

Form 30, Points with Blades Reworked into Alternative Tool Categories, N=9, (Figure 3:19-27).

These examples are projectile points that have been fashioned into other morphological categories but which have the original hafting elements and lower blade section intact. These alterations occur on both stemless and stemmed points. Of the nine stemmed examples, seven were recovered from Phase I tests. Additional information concerning these points can be located in Table 4. Nonstemmed examples are discussed within their respective categories.

Form 31, Indeterminate Fragments

Distal N = 52; Medial N = 9; Proximal N = 8.

The majority of these fragments are distal sections; medial sections are rare; proximal sections, since they retain the haft element, usually can be assigned to other categories.

ORDINATION AND CLUSTER ANALYSIS OF THE SMALL TRIANGULAR [illegible] POINTS: HAMILTON, MADISON, UNDESIGNATED

by Christopher [illegible] Peebles

[illegible] majority of the projectile points recovered from the Lubbub [illegible] locality can be [illegible] either to the Madison or Hamilton [illegible] "triangular" category. As a whole, [illegible] projectile points [illegible] many features in common. All [illegible] triangular blades [illegible] all are unstemmed; all seem to have been [illegible] and all show relatively well executed secondary [illegible] one another in terms of size, gross shape, blade [illegible] edge angle, raw material, heat treatment, and evidence of [illegible] reworking. Most of these dimensions of variability cross-cut [illegible] point types. For this reason, the unbroken examples of

TABLE 3

Descriptive Measures of Broken Stemmed Points

Figure	3:14	4:10	4:11	4:12	4:13	4:14	4:15	4:16
Length[1]	41	42.7	40	42.5	38.3	31.1	38.6	23.8
Width[1]	19	32.6	30.8	29.6	29.5	24.7	24.3	30.7
Thickness[1]	5.1	10.8	9.7	10.8	8	7.8	8	18.3
Basal Length[1]		8.6					13	13.8
Basal Width[1]		15.5			15.2	13.3	15.4	16
P.S.A.[2]	94	95	103		75	82	90	73
Blade Edge Angle I[2]	68	70	69	64	77	77	66	65
Blade Edge Angle II[2]	67	71	57	70	75	86	66	68
Basal Edge Angle[2]		103					180	180
Weight[3]	3.1	17	13	13.3	7.6	7.1	7.2	5.7
Material	Non-local	Local	Local	Non-local	Local	Non-local	Local	Local
Red Color Present	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Broken	Yes	Proximal	Medial	Yes	Yes	Proximal	Yes	Proximal
Blade Edge Shape I	Straight		Straight	Straight	Excurvate		Straight	
Blade Edge Shape II	Straight		Straight	Straight	Excurvate		Straight	
Basal Edge Shape		Excurvate					Incurvate	Straight

[1]mm
[2]degrees
[3]grams

TABLE 4

Descriptive Measures of Stemmed Points Which Have Blades Reworked into Other Tool Categories

Figure	4:19	4:20	4:21	4:22	4:23	4:24	4:25	4:26	4:27
Length[1]	38.4	45	40.2	53	32.2	30.7	36.4	33	25.8
Width[1]	47.4	20.7	22.7	26.8	34	32.8	33.8	24.3	[illegible]
Thickness[1]	8.5	10.5	7.1	6	8	7.9	8.5	8.7	6.2
Basal Length[1]	11.2	10.3	11.6	12.2	11.2	11.9	11.7	12.7	12
Basal Width[1]	21	12.8	14	15.5	14.7	15.8	14.7	16.3	[illegible]
P.S.A.[2]	107	79	83	80	84	82	80	105	98
Blade Edge Angle I[2]	50	84	71	63	61	55	43	81	75
Blade Edge Angle II[2]	46	65	76	66	65	54	51	82	
Basal Edge Angle[2]	32	56	77	69	180	61	52	[illegible]	75
Weight[3]	12.4	7.7	5	11.9	7.2	5.4	7.7	5.5	[illegible]
Material	Non-local	Local	Local	Local	Non-local	Non-local	Local	Non-local	Non-local
Red Color Present	No	Yes	Yes	Yes	No	No	No	Yes	[illegible]
Broken[4]	Yes	No	No	No	Yes	Yes	No	Yes	Yes
Blade Edge Shape I	Other	Excurvate		Other	Other	Other	Other	Other	
Blade Edge Shape II	Other	Other		Other	Other	Other	Other	Other	
Basal Edge Shape	Other	Straight	Other	Other	Straight	Straight	Straight	Other	Excurvate

[1] mm
[2] degrees
[3] grams
[4] Presumably, all these points were broken; the question here is whether they were broken subsequent to their "reworked" condition.

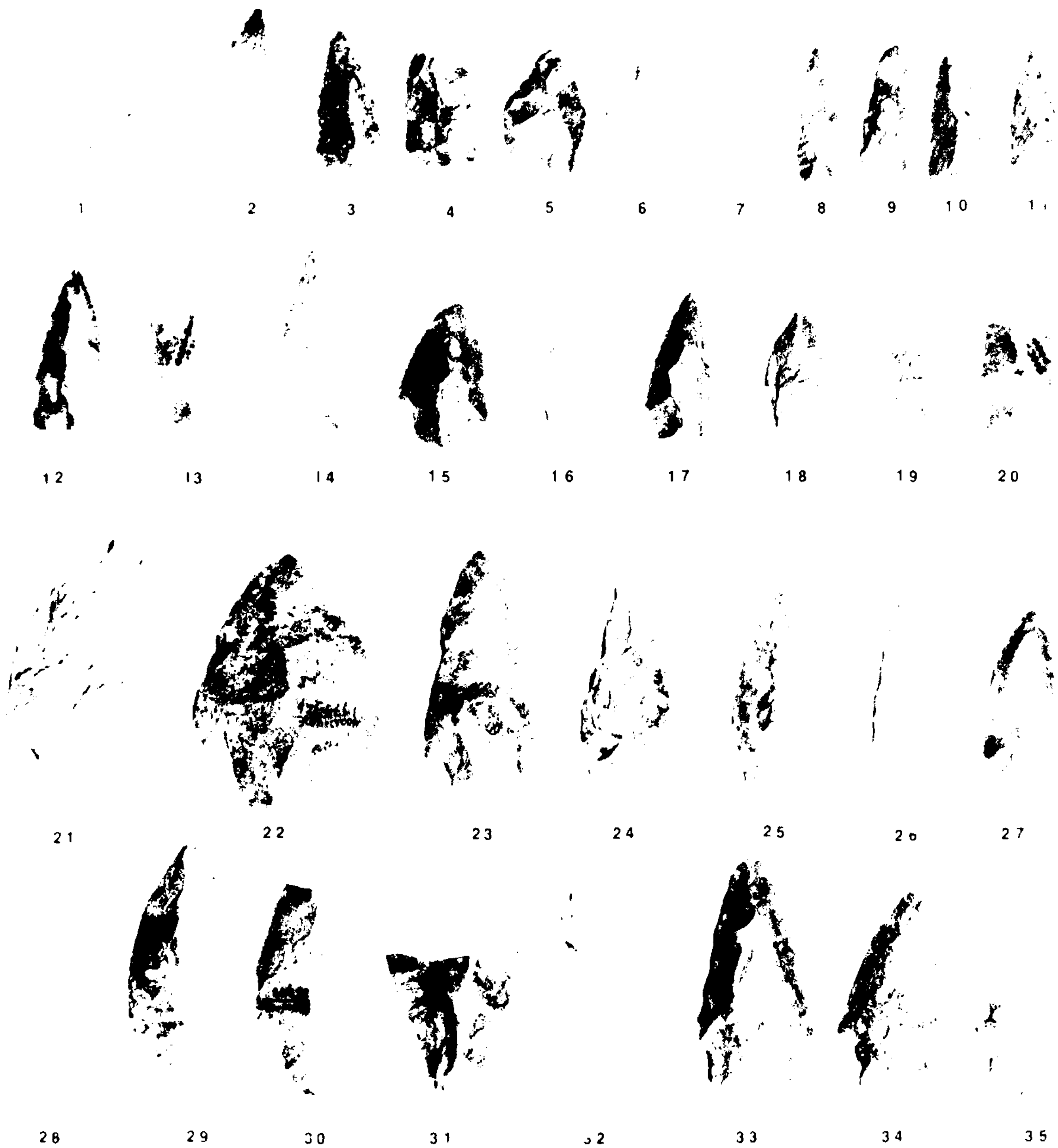


Figure 2. Projectile points from the Lubbub Creek Archaeological Locality: 1, 2, Large Triangular; 3, 4, Triangular, Rounded Base; 5, Jacks Reef Pentagonal; 6, 7, Broken Madison; 8, Nodena; 9-11, Guntersville-like: 12, Swan Lake; 13, Undesignated Expanded Stem; 14, Miscellaneous Stemmed; 15, 16, Coosa: 17, 18, Undesignated Small Stem: 19, 20, Broken Collins; 21, Undesignated Rounded Base: 22, Cotaco Creek; 23, Big Slough; 24 Undesignated Contracting Stem; 25, Undesignated "Knob" Stem; 26, 27, Undesignated Spike; 28, New Market: 29-32, Gary; 33, Bakers Creek-like: 34, 35, McIntire-like.

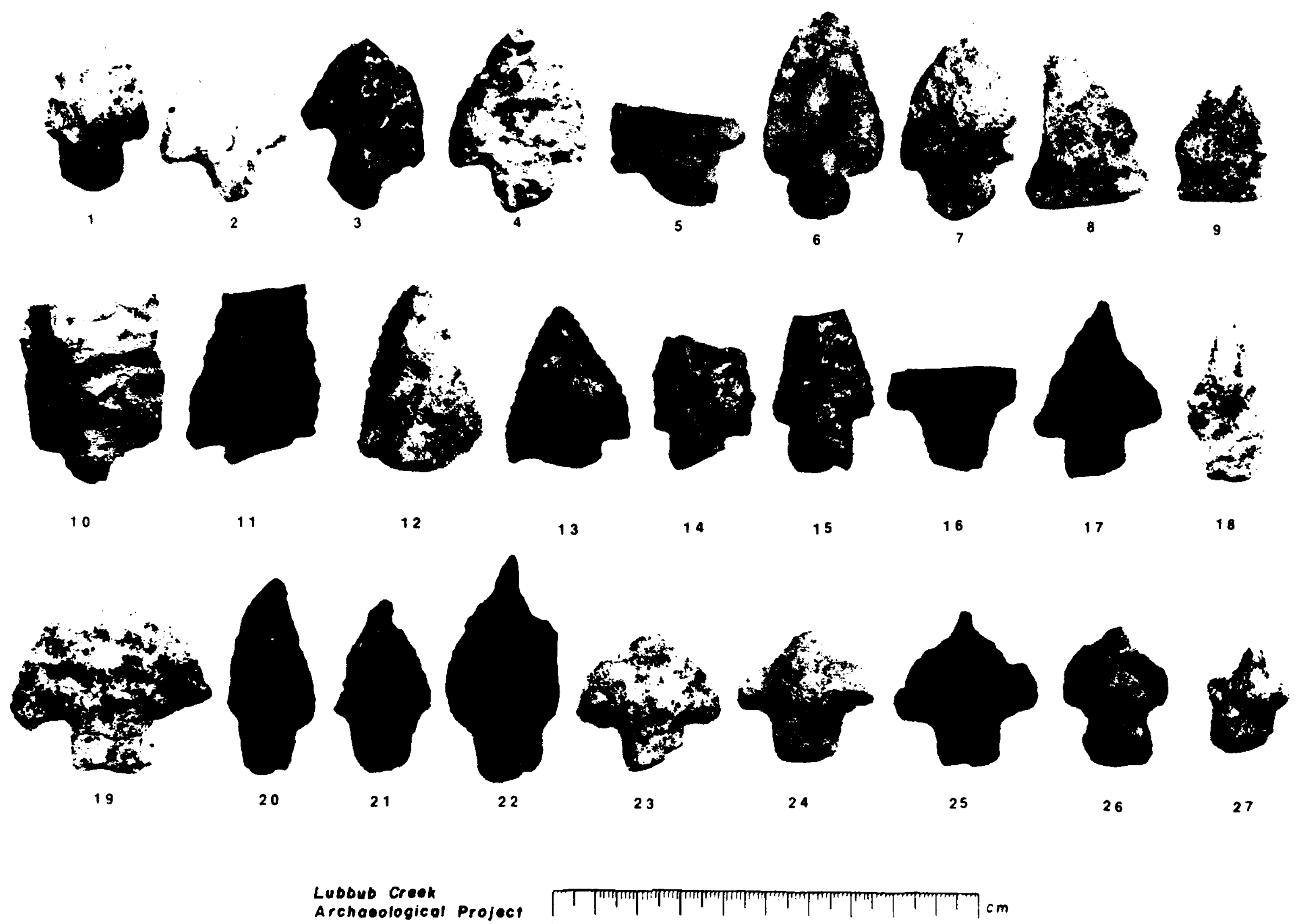


Figure 3. Projectile points from the Lubbub Creek Archaeological Locality: 1, Flint Creek; 2-5, Wade-like; 6, 7, Flint Creek; 8, 9, Shallow Side-Notch; 10-16, Indeterminate, Broken Stemmed; 17, Resharpened Straight Stemmed; 18, Resharpened Contracting Stemmed; 19-27, Reworked Projectile Points.

Madison, Hamilton, and "triangular" projectile points have been combined for the purposes of analysis. Rather than sorting into types and categories, numerical analysis -- in this case a combination of principal component analysis and cluster analysis -- will be used to classify these projectile points. In this way the degree of relationship among the objects can be measured, and summary statistical measures can be presented for each group of closely related projectile points.

The sample selected for analysis comprises 69 complete projectile points: 8 "triangular," 58 Madison, and 6 Hamilton. The descriptive measures and frequency distributions for this group are shown in Table 5. These projectile points range in length from 13 to 46.2 mm, in width from 9 to 20.20 mm, in thickness from 1.3 to 7 mm, and in weight from 0.2 to 2.9 g. Their length to width ratio varies from 0.76 to 2.58 mm; their shape ranges from triangles which have bases wider than their length, to equilateral triangles, to isosceles triangles. Their blade and base shapes can be either convex, concave, or straight. Blade edge angles range from a narrow 33 degrees to a blunt 102 degrees; basal edge angles vary from 39 degrees to a flat 180 degrees. Most but not all of these projectile points are made from local chert, and approximately two-thirds are made from heat-treated chert. Only two show signs of reworking.

The range of values for the several measures and their associated standard deviations suggest that these 69 projectile points make up a highly variable population. Moreover, the inclusion of the length to width ratio, although it is an excellent measure of overall shape, does introduce an element of redundancy into the set of variables. Because the construction of meaningful groups is the goal of this analysis, both random variation and the logical redundancy should be removed prior to the cluster analysis. One way to remove random and unimportant variability and to factor out the redundancy is by principal component analysis. This numerical method extracts linear combinations of variables which account successively for the greatest amount of variability, the second greatest amount of variability, and so on. In effect, principal component analysis reduces the dimensionality of the original symmetric Q or R matrix. In this case, once the symmetric attribute matrix has been reduced to its essentials, the projectile points and their original measures can be projected onto this component space. The original variables can be replaced by a lesser number of component scores. These component scores then can be used as the data for cluster analysis. This combination of techniques has been used in archaeology to analyze Swiss Neolithic ceramics (Whallon, Peebles, and Kus 1975) and has been employed to analyze a wide variety of other kinds of data (Sneath and Sokal 1973:245-246).

The results of the principal component analysis are shown in Table 6. If the significant components are defined as those with eigenvalues greater than 1.0 and those which encompass a cumulative percent variance extracted of at least 75 percent, then these data can be reduced to four principal components. The fifth principal component has been included in Table 5, but it will not be used in subsequent parts of the analysis. In effect, the original 11 variables have been reduced to four linear combinations of these variables.

Component 1 combines all the variables except base and blade shape. In classic factor analysis, Component 1 would be called the "size" factor. Component 2 focuses on length, width, weight, and edge angles. Again, in the

TABLE 5

Descriptive Measures of Small Triangular Projectile Points.

N=69	Minimum	Maximum	Mean	Standard Deviation
Length[1]	13.00	46.20	2.64	6.00
Width[1]	9.00	20.20	14.14	2.48
Thickness[1]	1.30	7.00	4.38	0.99
Basal Concavity[1,2]	-2.00	1.90	0.46	0.70
Blade Edge Angle I[3]	33.00	96.00	70.87	11.72
Blade Edge Angle II[3]	36.00	102.00	71.74	12.91
Basal Edge Angle[3]	39.00	180.00	67.57	19.02
Weight[4]	0.20	2.90	1.11	0.48
Length to Width Ratio	0.76	2.53	1.62	0.39
Blade Shape I[5]	-1.00	1.00	0.09	0.61
Blade Shape II[5]	-1.00	1.00	0.08	0.64
Material	Local	61	Non-local	8
Heat Treated	Yes	45	No	24
Reworked	Yes	2	No	67

[1]mm
[2]negative value indicates a convex base
[3]degrees
[4]gms
[5]-1.00=concave; 0.00=straight; +1.00=convex

TABLE 6

Principal Component Analysis

	Component				
	1	2	3	4	5
Eigenvalue	2 875	2.300	1.608	1.296	0.946
% Variance	26 14	47 95	62.5'	74.35	82.96
Length	4399	.3665	.1023	-.2286	-.1190
Width	2289	.3339	-.3891	.4037	-.0581
Thickness	.3907	-.0705	-.1936	.1646	.3629
Basal Concavity	.0025	.0122	-.2854	.4312	.7722
Blade Edge Angle I	.2910	-.4787	.0302	.1862	.0002
Blade Edge Angle II	.3342	-.4526	.0627	.1512	.0230
Basal Edge Angle	.2482	-.3478	.2613	.0761	.0785
Weight	.4718	.3555	-.0295	.1661	.0053
Length to Width Ratio	.3117	.1112	.4226	.5142	-.1145
Blade Shape I	-.1454	.1879	.4950	.2961	.2127
Blade Shape II	-.0538	.1622	.4698	.3589	4353

language of factor analysis this would be called a bipolar factor. It shows the inverse relationship among two sets of variables. Component 3 is constructed for the most part from variables that measure shape: overall shape and blade shape. Component 4 extracts width and blade shape and contrasts those variables with overall shape and basal concavity. Component 5 is primarily a measure of basal concavity, but it extracts some of the remaining variability in the shape of the blade as well.

Component scores for the first four principal components were calculated for each projectile point. The projectile points were then grouped by a polythetic agglomerative clustering algorithm which minimized the error sum-of-squares in each fusion of individuals or clusters. (The algorithm is called "Ward's Method" and further confirmation can be found in Peebles, 1974.) The 69 projectile points were grouped finally into 7 clusters. The so-called "scree" test was used to make the choice of the final number of clusters. The value of the error sum-of-squares was graphed for each fusion, and the point at which the slope of the line made a drastic change was used as the stopping point. In this case the line becomes nearly vertical after the group has been reduced to 7 clusters.

The descriptive statistics for the 7 clusters are given in Table 7. The success of this analysis can be judged by a comparison of the standard deviations of the several variables for the group as a whole (Table 5) and the seven clusters (Table 7). There has been a marked reduction in the coefficient of variability for all measures. The 69 projectile points arranged in the order of their similarity measures are shown in Figure 4. The individual clusters and their measures are described below.

Cluster 1 contains three projectile points. The mean measures for this group are: length 22.27 mm, width 14.00 mm, thickness 3.43 mm, and weight 0.87 g. The average length to width ratio is 1.62. The bases of these projectile points are concave and their blades are convex. The blade and base edge angles, which are the variables that set this cluster apart from the others, are extremely narrow. The average edge angles of the two blades are 41 and 48 degrees; the average edge angle for the base is 41.33 degrees. All of these projectile points are fabricated from local, heat treated chert, and none show evidence of being reworked. In the classic typology, two of these would be called Madison and one would have been placed in the residual triangular category.

Cluster 2, which is the second largest of the seven clusters, contains [illegible] projectile points. The mean measures for this group are: length [illegible] mm, width 13.29 mm, thickness 3.73 mm, and weight 0.64 g. The average length to width ratio is 1.31, and it is this variable which sets this cluster apart. It shows that the shape of these projectile points is generally that of an equilateral triangle. The base and blade shapes are concave, and the edge angles for these three sides are all nearly 60 degrees. These morphological variables serve to further separate Cluster 2 from the other six clusters. All but one of the members of this cluster are made from local chert, [illegible] but three have been heat treated, and only one appears to have been reworked. All but one of these projectile points fits within the Madison category, and the lone exception can be put in the residual triangular class.

Cluster 3, which contains nine projectile points, is most like Cluster 2.

TABLE 7

Descriptive Measures for Clusters 1 to 7

		Cluster						
		1	2	3	4	5	6	7
	N	3	16	19	8	13	17	3
Length[1]	x	22.27	17.11	21.22	24.68	31.11	20.69	25.73
	s	4.08	2.93	3.27	3.48	5.15	3.14	5.97
Width	x	14.00	13.29	11.58	14.66	16.68	14.72	10.77
	s	1.65	2.06	0.81	1.80	2.22	1.93	1.66
Thickness[1]	x	3.43	3.73	3.79	5.64	4.80	4.48	4.80
	s	0.32	0.72	0.54	0.95	0.61	1.02	0.72
Basal Concavity[2]	x	0.57	0.59	0.87	0.71	0.43	0.15	0.27
	s	0.25	0.60	0.56	0.48	0.53	0.82	1.42
Blade Edge Angle I[3]	x	41.00	63.00	72.33	75.63	69.31	78.65	88.33
	s	8.54	8.69	5.52	6.67	6.66	8.07	6.66
Blade Edge Angle II[3]	x	48.00	60.25	72.33	82.25	69.69	80.06	88.67
	s	10.81	8.20	6.32	11.45	9.25	7.21	10.26
Basal Edge Angle[3]	x	41.33	58.00	71.11	70.13	60.46	74.53	118.67
	s	3.21	10.57	7.62	8.34	13.09	8.46	53.58
Weight[4]	x	0.87	0.64	0.81	1.29	1.80	1.17	1.03
	s	0.23	0.23	0.15	0.29	0.38	0.32	[illegible]
Length to Width Ratio	x	1.62	1.31	1.83	1.69	1.89	1.42	[illegible]
	s	0.46	0.26	0.25	0.25	0.37	0.22	[illegible]
Blade Shape I[5]	x	1.00	-0.63	0.00	-0.88	0.00	0.12	[illegible]
	s	0.00	0.25	0.00	0.35	0.00	0.49	[illegible]
Blade Shape II[5]	x	0.67	-0.63	-0.22	-0.63	0.09	0.18	0.33
	s	0.58	0.57	0.44	0.74	0.28	0.39	0.58
Material	Local	3	15	8	7	11	14	3
	Non-local	0	1	1	1	2	3	0
Heat Treated	Yes	3	13	7	2	6	11	3
	No	0	3	2	6	7	6	0
Type	Small Triangular	1	0	0	4	1	1	1
	Madison	2	16	7	1	12	16	2
	Hamilton	0	0	2	3	0	0	0

[1] mm
[2] negative value indicates convex base
[3] degrees
[4] grams
[5] -1.00=concave; 0.00=straight; +1.00=convex

Differences in the length to width ratio, blade shape, and blade edge angle, however, tend to distinguish it from this cluster. The mean measures for Cluster 3 are: length 21.22 mm, width 18.58 mm, thickness 3.79 mm, and weight 0.81 g. The average length to width ratio is 1.83. The projectile point bases are concave, and the blades range from straight to slightly convex. The mean edge angle for both blades is 72 degrees, and the basal edge angle is 71 degrees. All but one of these nine projectile points are made from local chert, and all but three show the effects of heat treatment. None show signs of reworking. Seven of these projectile points would be classified as Madisons; two would be called Hamiltons.

Cluster 4 encompasses eight of the thickest projectile points in the sample. This variable, plus the relatively large blade angle and basal edge angles tend to separate this cluster from the others. The mean measures for Cluster 4 are: length 24.68 mm, width 14.66 mm, thickness 5.64 mm, and weight 1.29 g. The blades and bases are concave. The basal edge angle is approximately 70 degrees; the blade edge angles are 75 and 82 degrees. Seven of the projectile points are made from local chert, only two are heat treated, and none shows signs of reworking. In classic terms, one is a Madison, three are Hamiltons, and four would be placed in the residual triangle category.

Cluster 5 contains thirteen projectile points. The projectile points in this cluster are among the largest in the sample. The mean measures for this group are: length 31.11 mm, width 16.68 mm, thickness 4.80 mm, and weight 1.80 g. The average length to width ratio is 1.89. The blade edges are straight and the bases are concave. The average blade edge angle for both blades is 69 degrees, and the basal edge angle is 60 degrees. Eleven of the projectile points are made from local chert, only six are heat treated, and none show signs of reworking. All but one of these projectile points fit into the Madison type, and the single exception is a member of the residual triangular category.

Cluster 6, which is the largest of the seven clusters, contains 17 members. The blade and basal edge angles serve to set this cluster off from the others. The mean measures for this group are: length 20.69 mm, width 14.72 mm, thickness 4.48 mm, and weight 1.17 g. The projectile point bases are concave and the blades are straight to convex. The blade edge angles are 78 and 80 degrees; the basal edge angle is 74 degrees. All but three of these projectile points are made from local chert, and all but six are heat treated. One shows signs of reworking. Sixteen of these projectile points would be placed in the Madison category; one would be put in the residual triangular category.

Cluster 7, like Cluster 1, is somewhat of an odd-ball group. The projectile points in this cluster are long and narrow; their length to width ratio of 2.37 sets them off from all the other clusters. The mean measures for this group are: length 25.73 mm, width 10.77 mm, thickness 4.80 mm, and weight 1.03 g. The bases in this cluster range from concave to convex, and the blades are straight to convex. The blade edge angles both average 88 degrees, and the average basal edge angle is more than 118 degrees. All of these projectile points are fabricated from local, heat treated chert, and none show signs of reworking. Two fit within the Madison type, and one is within the limits of the residual triangular class.

It is apparent from the above analysis that neither a single variable nor a single group of variables can serve to classify these triangular projectile points. The three groups of measures that define shape, size, and edge morphology combine in different ways in each of the clusters. Clusters which contain projectile points of similar size and shape may be distinct from one another when edge angle is taken into consideration. Conversely, clusters which contain projectile points of different sizes may be close to one another when shape and edge angles are considered. When all three major dimensions of variability are considered simultaneously, the results are both visually and statistically satisfying.

SPATIAL AND TEMPORAL IMPLICATIONS OF THE CLUSTER ANALYSIS

Although by no means unequivocal, there is a pattern in space and time among the members of the seven clusters of triangular projectiles points. From the total of 69 examples, 19 of these projectile points can be placed in cultural and temporal contexts. The remaining 50 examples, which were recovered either from Phase I test units or 1 m^3 plowzone samples, can be assigned locations within the Lubbub Creek Archaeological Locality (Figure 5).

The three projectile points in Cluster 1 all were found near the river bank in the extreme eastern part of the project area. None were found in a secure cultural or chronological context.

Of the 16 projectile points in Cluster 2, four can be assigned a place in the site's chronology. Two came from Miller III features, one from a "Mississippian" feature, and one from a Summerville IV feature. Examples from this cluster were found in almost every hectare that was excavated.

Cluster 3 contained 9 projectile points, three of which could be placed in the site's chronology. All three were found in Miller III features. The general distribution of this group of projectile points encompassed an area south and east of the mound.

Of the eight projectile points in Cluster 4, two were found in mixed, Late Woodland and Mississippian contexts, and one was recovered from a Summerville IV feature. All but one of these projectile points were found west of the mound.

Cluster 5 contained 13 projectile points. Four of these points were found with a Summerville II period burial in Hectare 400N/-400E. These four points are identical to the eye, and the cluster analysis confirms this visual classification. Another member of this cluster was found in a feature near [illegible] it too can be placed in the Summerville II period. Three [illegible] from this cluster were found in the mound, and, with one exception, [illegible] were located west of the mound.

[illegible] 17 projectile points in Cluster 6, only three have cultural [illegible] associations. One was found [illegible] a Miller III feature, one was recovered from a Mississippian feature, and one was located in a Summerville [illegible] feature. All [illegible] tile points were found in the hectares near the mound.

All three members of Cluster 7 were found in 1 m^3 plowzone samples. All

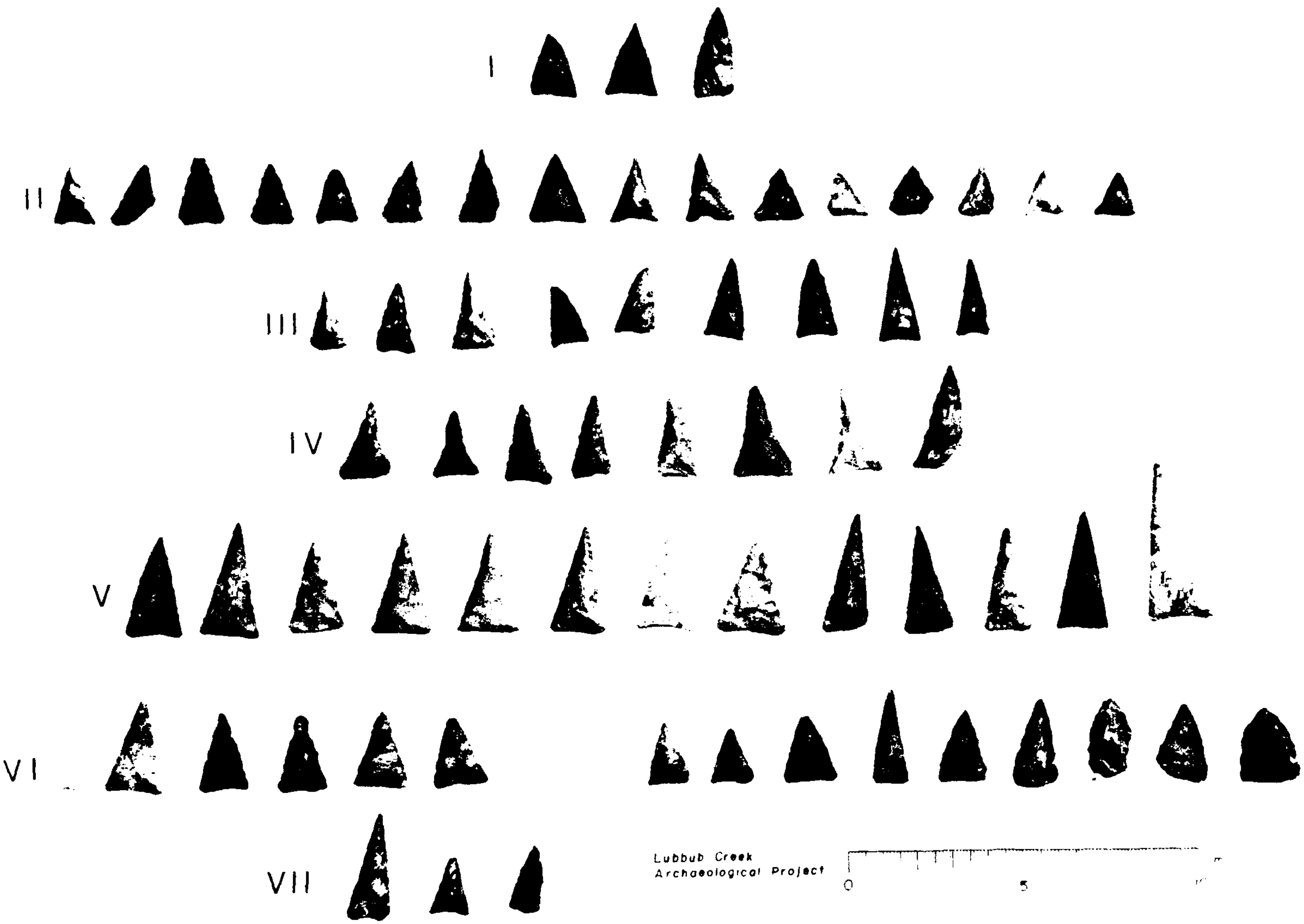


Figure 4. Madison, Hamilton, and Small Triangular projectile points in Cluster order, all from left to right. Cluster 1, USN 197, 931, 235; Cluster 2, USN 260, 165, 6606, 156, 2401, 6607, 30, 144, 366, 1924, 189, 69, 6689, 1397, 151, 1799; Cluster 3, USN 260, 1599, 2570, 4453, 3309, 6482, 5523, 4542, 2294; Cluster 4, USN 227, 654, 1556, 2509, 6690, 3586, 4125, 4542; Cluster 5, USN 665, 2823, 146, 2823, 2823, 2823, 4542, 1553, 794, 2110, 5049, 2510, 4542; Cluster 6, USN 2570, 3586, 2230, 1480, 2321, 5057, 4123, 2233, 4719, 2473, 3586, 5046, 2407, 3899, 1799, 4549, 4860; Cluster 7, USN 3114, 5046, 6684.

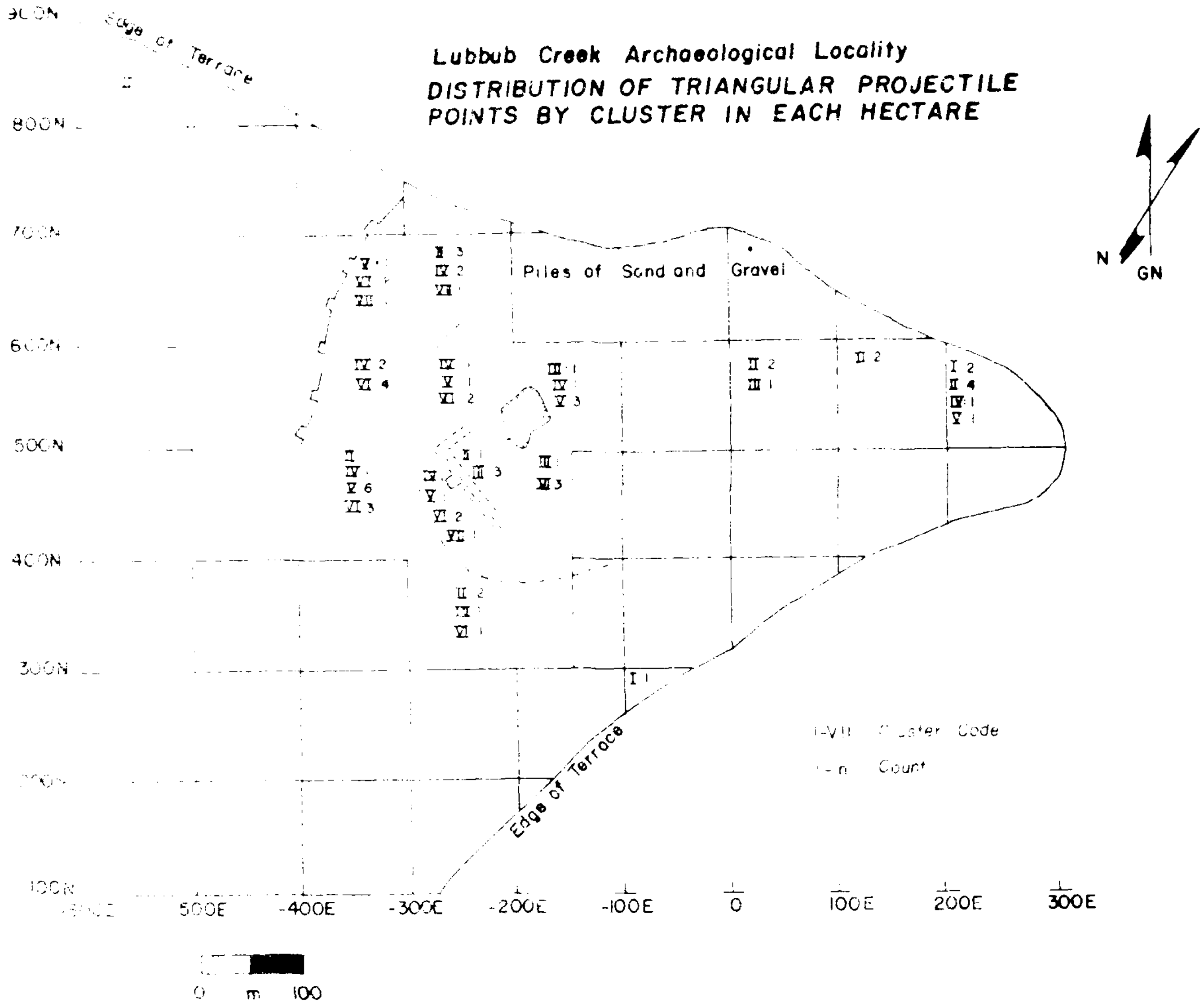


Figure 5. Distribution by hectare of triangular projectile point clusters.

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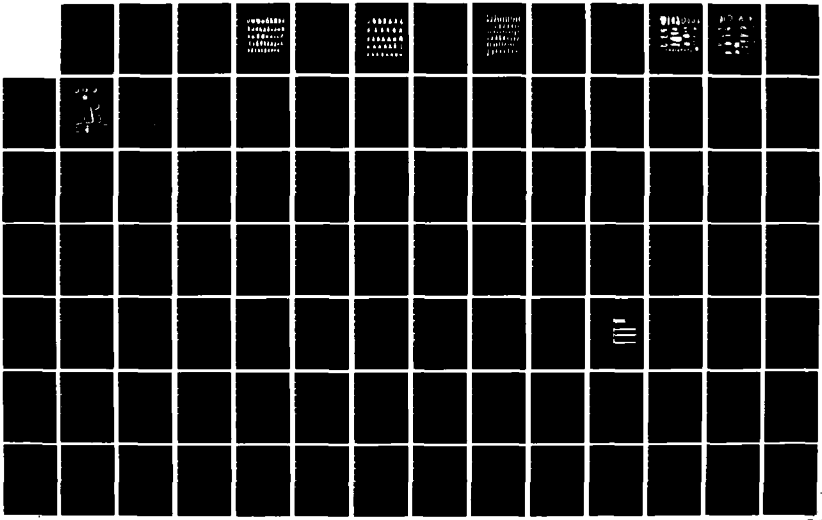

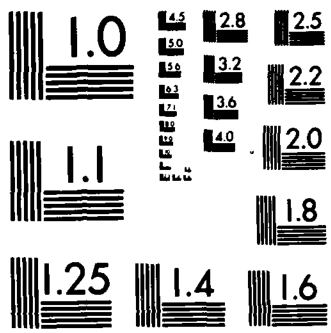

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

were recovered from areas west of the mound.

Although the trends are not clear, it seems as though Clusters 2 and 3 are candidates for assignment to the Miller III and Summerville I periods, whereas Clusters 4 and 5 seem to be associated with the mature Mississippian, Summerville II and III, and the protohistoric, Summerville IV periods. The only real trend in cultural context is the relationship between almost one-half the members of Cluster 5 and symbolic contexts, either a burial or the mound.

SPATIAL AND TEMPORAL ASSOCIATION OF PROJECTILE POINT TYPES

From the total of 277 projectile points recovered from Phase I through III excavation units, 63 were recovered from contexts that permitted approximate chronological assignments. It should be noted that among the Madison, Hamilton, and small triangular forms, whole projectile points and point fragments are included here, whereas in the cluster analysis of these types, only unbroken points were in the sample. It should also be pointed out that the relationship between the seven clusters and chronology was much tighter than between projectile point type and chronology.

Of the 41 Madison points recovered in context, 5 were in Miller III features, 7 were associated with mixed Late Woodland and Mississippian deposits, 23 were from Mississippian (Summerville I through III) features, and 5 could be assigned to the protohistoric (Summerville IV) period. The 12 Hamilton points were divided evenly between Late Woodland and Mississippian features: 6 Miller III, 1 mixed Late Woodland-Mississippian, 3 Mississippian (Summerville I through III), and 2 protohistoric (Summerville IV). One small triangular point could be assigned to the Miller III period, two to the Mississippian, and one to the protohistoric period.

A Guntersville-like point, two Coosa points, and an undesignated shallow side-notched point were recovered from Miller III features. One undesignated "knob" stemmed point was found in a mixed Late Woodland and Mississippian deposit. One Flint Creek point was in a Mississippian feature.

Twelve projectile points were recovered from the mound deposits. Eight of these were Madison points. The remainder included one undesignated spike, one McIntire, one undeterminate stemmed, and one fragment.

The majority of the projectile points recovered during the Phase I through III excavations, as well as those that resulted from the University of Alabama, Office of Archaeological Research's work in 1977 (Ensor 1979), were either Hamilton, Madison, or small triangular forms. All of these projectile points can be assigned to the Late Woodland and Mississippian periods. The greater part of the remaining projectile points, the stemmed and side-notched forms, indicate a few Late Archaic through Middle Woodland components. The single Big Slough point suggests an Early to Middle Archaic component.

BLANKS AND PREFORMS

In his glossary of flintworking terms, Crabtree defines a blank as:

> ...a usable piece of lithic material of adequate size and form for

> making a lithic artifact -- such as unmodified flakes of a size larger than the proposed artifact, bearing little or no waste material, and suitable for assorted lithic artifact styles. The shape or form of the final product is not disclosed in the blank (Crabtree 1972:42).

In contrast,

> Preforming denotes the first shaping. Preform is an unfinished, unused form of the proposed artifact. It is larger than, and without the refinement of the completed tool. It is thick, with deep bulbar scars, has irregular edges, and no means of hafting. Generally made by direct percussion. Not to be confused with a "blank." (Crabtree 1972:42).

Both blanks and preforms have been identified among the lithic artifacts recovered from the Lubbub Creek Archaeological Locality. Because they were made from cobbles of varying size and shape, the line dividing members of these two categories is somewhat tenuous. Generally, the degree to which a form has been roughed out is the criteria that has been used to separate the two forms.

<u>Blanks</u>, N=35 (Figure 6:1-28, 31, 35-38, 48-49).

Ensor (1979:24) has characterized blanks as "...unfinished pieces of raw material... an intermediate stage in the production of a stone tool." He observes further that blanks are thick, evidence massive, unpatterned flaked scars, and show hinge fractures that prevented further thinning. They are, in fact, cobbles which have been flaked crudely on all surfaces, perhaps used for a task at hand, perhaps reduced further, but ultimately discarded in an unfinished form.

All but two blanks were recovered either in 1 m^3 plowzone samples or in Phase I test units. Of the two remaining blanks, one was found near the mound, the other in the ditch that encircled the Summerville IV community.

<u>Stemmed Preforms</u>, N=3 (Figure 6:32-34).

Three crudely flaked, triangular preforms with prototypical stems at their base suggested unfinished projectile points. All three artifacts were recovered in 1 m^3 plowzone samples.

<u>Thin Preforms</u>, N=12 (Figure 6:29-30, 39-47).

These thin preforms exhibited irregular flake removal scars but lacked the fine edge pressure flaking usually equated with finished tools; they were all quite thin (<8 mm), and some may have served as knives. Macroscopic examination of the edges, however, revealed no evidence of use. All these artifacts were found either in the 1 m^3 plowzone samples or Phase I test units.

<u>Triangular Preforms</u>, N=39 (Figure 7).

Most of these preforms were small, thick, and trianguloid. They lacked

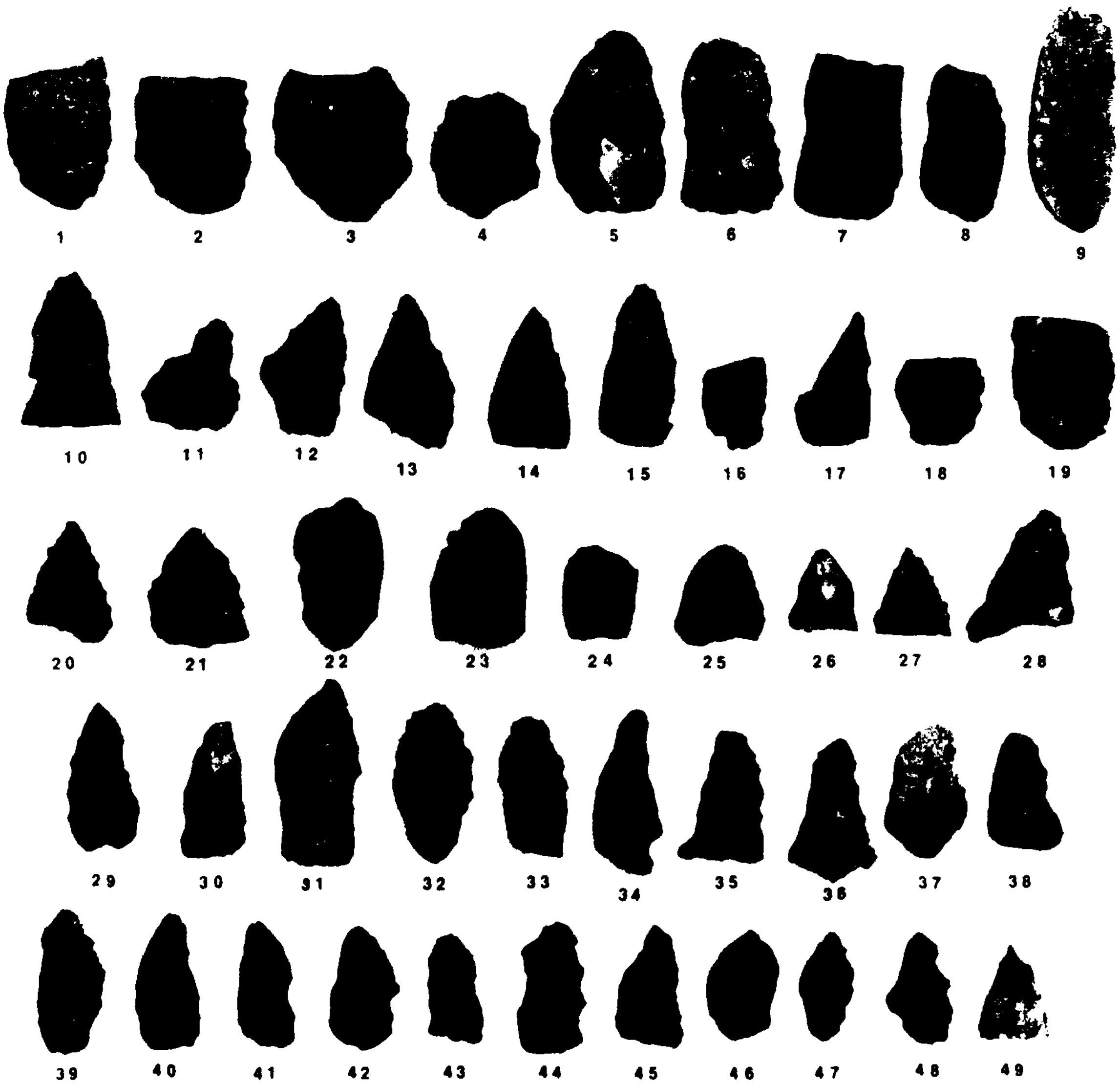

Figure 6. Blanks and Preforms from the Lubbub Creek Archaeological Locality: 1-28, 31, 35-38, 48-49, Blanks; 32-34, Stemmed Preforms; 29, 30, 39-47, Thin Preforms.

fine pressure flaking which characterized finished triangular projectile points (Forms 1-3), but they presumably were destined as such. Sixteen of these specimens possessed some cortical material, and two of these had cortex on both sides. Figure 7:7 has cortex surrounding the base which shows a pebble to finished tool relationship. Two of these preforms were associated with a Summerville I structure, two were recovered from a Summerville IV structure, one was found in a Mississippian pit, and one was found in the ditch. The remainder came from plowzone samples and test units.

DRILLS AND MICROLITHS

One of the major accomplishments of the University of Alabama, Office of Archaeological Research investigations in the Lubbub Creek Archaeological Locality was the definition of an indigenous microlithic industry (Ensor 1979:243-266). This microlithic assemblage extends the boundaries of such industries far to the southeast of Cahokia in Illinois and Zebree in Arkansas and fills in a spatial gap between these assemblages and those of northwest Florida and southwest Georgia. The basics of the Lubbub microlithic industry include heat treatment of river cobbles, rather precise core preparation, the production of small prismatic and lenticular blades, and the secondary working of these blades into drills and gravers (Ensor 1979:243-256). Ensor defined this industry from a sample of 197 artifacts, 89 of which were found in one level of a single pit. Based on the occurrence of other artifacts, especially shell beads, Ensor believes that the microliths were used to manufacture these beads (ibid:266).

There is an interesting contrast between the microlith assemblage that Ensor described and microlithic artifacts recovered by the Phase I through III excavations reported here. In a hundred-fold increase in volume of the Phase I through III excavations, we recovered less than one-half the total number of microliths than did Ensor. Second, far fewer microlithic cores were found in our excavations than his. Third, the majority of our microliths did not evidence thermal alteration, whereas the vast majority of those reported by Ensor were heat treated.

For purposes of discussion here, the microlithic drills will be presented as part of a larger discussion on drills in general. Where distinctions are clear-cut, however, drills that are products of the Lubbub microlithic industry are described apart from the others.

Drill Preform, N=22 (Figure 8:54-61).

These small, bifacially retouched, rod-like artifacts showed no macroscopic evidence of use-wear, hence the designation preform. Two of these drill preforms were made from large blades; seven of the smaller examples retained some residual cortex; the remainder of the small examples were retouched to the point that any clue to their original form had been obliterated. Five of these artifacts were found in controlled contexts: one in a Miller III pit, two in Mississippi period middens, and two in protohistoric, Summerville IV pits.

Stemmed Drill, N=1 (Figure 8:1).

One "classic" drill had the characteristic long, thick, but narrow bit,

Figure 7. Triangular Preforms from the Lubbub Creek Archaeological Locality.

expanded base, and slightly tapered haft element. This artifact was found in a Phase I test unit east of the mound, in an area with Late Archaic and Early Woodland components.

Expanded Base Drills, N=3 (Figure 8:2, 33, 34).

These drills have long, narrow, thick bits and a triangular, expanded and thinned base. All three examples were recovered from uncontrolled contexts.

Shaft Drills, N=8 (Figure 8:4-12).

These drills have long, narrow, thick bits and a base that is the same basic shape as the shaft. Two examples have residual cortex on their bases. Three are definitely fabricated from blades. Of the three recovered from controlled contexts, two were in the mound, and one was in the fill from a protohistoric, Summerville IV structure.

Microdrills, N=12 (Figure 8:46-53).

By definition here, microdrills are small (less than 3 cm long), bifacially retouched, single-pointed implements. For the most part, these items conform to the definition given by Ensor (1979:253) for "Class 3" microlithic artifacts. One of these drills was found in the mound fill and one in a Summerville II-III period structure; the remainder were recovered from 1 m^3 plowzone samples.

Other Drills, N=5 (Figure 8:42-45).

There are five single-pointed, bifacially retouched "drills" which have a diverse, irregular morphology. They have been lumped into this catch-all category.

Drill Fragments, N=27 (Figure 8:35-39).

Among the fragments of drills were four proximal, five medial, and eighteen distal sections. One was recovered from a Miller III pit, one was found in a protohistoric, Summerville IV structure, and three were located in Mississippian pits. The remainder come from uncontrolled contexts.

FLAKED COBBLES

Longitudinal Edge Flaked Cobbles, N=19 (Figure 9:1-8; Figure 10:1-8).

Cobbles, either bifacially or unifacially flaked along one longitudinal edge, were designated as either unifacial or bifacial knives in the preliminary laboratory analysis and in Volume III. Here, they are given a more descriptive name. These tools have macroscopic evidence of use along the retouched edge. There are nine bifacial and ten unifacial examples in the collection. One of the bifacial cobbles was made from petrified wood and was found in the mound; the remainder were made from chert, and two of these which came from a controlled context were found in a Mississippian midden. The unifacial flaked cobbles all are made from chert. Three of these unifaces come from controlled contexts: one from a Summerville I structure, one from a Summerville II-III structure, and one from a protohistoric, Summerville IV

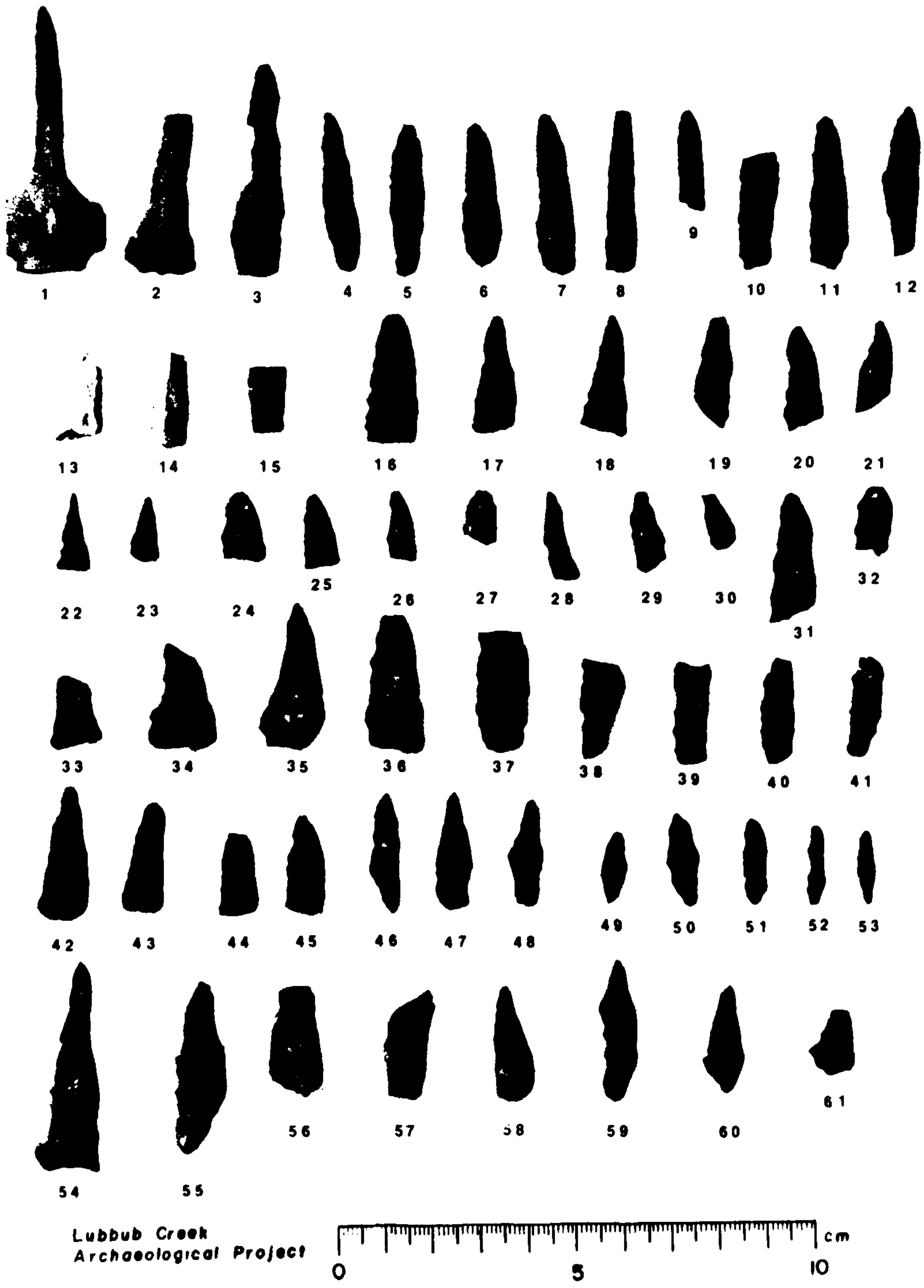

Figure 8. Microliths and drills from the Lubbub Creek Archaeological Locality: 1, Stemmed Drill; 2, 33, 34, Expanded Base Drills; 3, Other Drills; 4-12, Shaft Drills; 13-32, 35-39, Drill Fragments; 40, 41, 46-53, Microdrills; 54-61, Preforms.

shell concentration.

Transverse Edge Flaked Cobbles, N=13 (Figure 9:9-11; Figure 10:9-16).

Cobbles either bifacially or unifacially flaked along one transverse edge were designated as either unifacial or bifacial scrapers in the preliminary laboratory analysis and in Volume III. As with the longtitudinally flaked cobbles, these artifacts have been renamed to eliminate the functional denotation. Also, like the longitudinally flaked cobbles, these cobbles flaked along their transverse edge exhibited use-wear along their retouched surface. Three of these cobbles were flaked bifacially and ten were flaked unifacially. One of the unifacial examples was found in a Mississippian context, and the other two were recovered from uncontrolled contexts. One of the bifacial examples was recovered from a Miller III pit, two were found in protohistoric, Summerville IV pits, and one was taken from the mound fill. The remainder were recovered from 1 m^3 plowzone samples and Phase I test units.

Chisel Edge Cobbles, N=4 (Figure 9:12-14, 19).

These tools are similar to the transverse edge flaked cobbles, but they differ in two important respects. Chisel edge cobbles have fine secondary retouch on the worked edge and cortex on the rest of the surface. One of the three examples was found in a mixed Miller III and Mississippian deposit.

One preform has been retouched along one transverse edge to yield a tool like the chisel-edge cobbles. It differs from them only in the absence of cortex.

Concave Scrapers, N=9 (Figure 10:19, 20, 21, 22, 24, 25, 26).

Pebbles with notches worked by unifacial percussion into one edge have been designated concave scrapers. The term "spokeshave" would have been an equally appropriate term. One of these tools was found in a Summerville II-III structure; two were recovered from isolated postmolds; six were in uncontrolled contexts.

FLAKE TOOLS

Worked Flakes, N=25 (Figure 9:16-18; Figure 10:27-28).

There are a few free flakes, with and without residual cortex, which show either unifacial or bifacial retouch and subsequent use-wear. Twenty are bifacially retouched and five are unifacially retouched. All the unifacial examples come from Mississippian contexts; one bifacial example comes from a protohistoric, Summerville IV structure.

Perforators and Gravers, N=17 (Figure 9:20, 28-39; Figure 10:36-40).

Some free flakes have short, pressure flaked projections that are either pointed or burin-like. Among the twelve bifacial examples, one was found in a Miller III pit, two were in the ditch, one was recovered from the floor of a protohistoric, Summerville IV structure, one was located on the floor of a Summerville I structure, one was recovered from a Summerville I structure

under the mound, one was found in a mixed Mississippian deposit, and the remainder came from uncontrolled contexts. Of the five unifacial examples, two came from the mound fill, the remaining three are part of Summerville II-III and protohistoric, Summerville IV contexts.

Side Scraper, N=2

Two free flakes show steep unifacial retouch on one edge. Both were recovered from uncontrolled contexts.

MISCELLANEOUS CHIPPED LITHICS

Twenty chert fragments, which were of various sizes and shapes, all evidenced fine, secondary retouch. These fragments were probably the remains of small triangular projectile points.

Unretouched blades were rare elements in the Lubbub Creek Archaeological Locality. During Phases I through III, only 25 of these artifacts were recovered.

GROUND, PECKED, AND POLISHED STONE

End-Pecked Cobbles, N=22

These hammerstones, which were waterworn cobbles with evidence of battering on one end, were recovered in most areas of Lubbub Creek Archaeological Locality.

Pitted Stones, N=10

Several cobbles had cup-shaped depressions pecked into their flat surfaces. These rocks usually are called "nutting stones."

Grooved Sandstone, N=78

Commonly classified as "abraders," these artifacts are flat pieces of sandstone with use-worn grooves cut into their surfaces. Some of these artifacts may have been used to straighten cane by drawing it through the grooves. Cosner, who experimented with this technique, concluded: "This stone not only proved to be a good way to form cane; it is the only way I know of" (1951:148).

Ground Sandstone, N=342

Fragments of ground sandstone were found throughout the site. Most of these pieces were quite small, but one large, 10 kg piece was recovered from the mound, and another, 6.2 kg piece was found near the outer palisade.

Greenstone Celts, N=15 (Figure 11:10-15).

Three whole and twelve fragmentary greenstone celts were recovered from the Lubbub Creek Archaeological Locality. The largest of these celts was 14.4 cm long (Figure 11:11) and was found in the mound fill. Four celt fragments also were recovered from the mound area. The remainder of the celts and celt

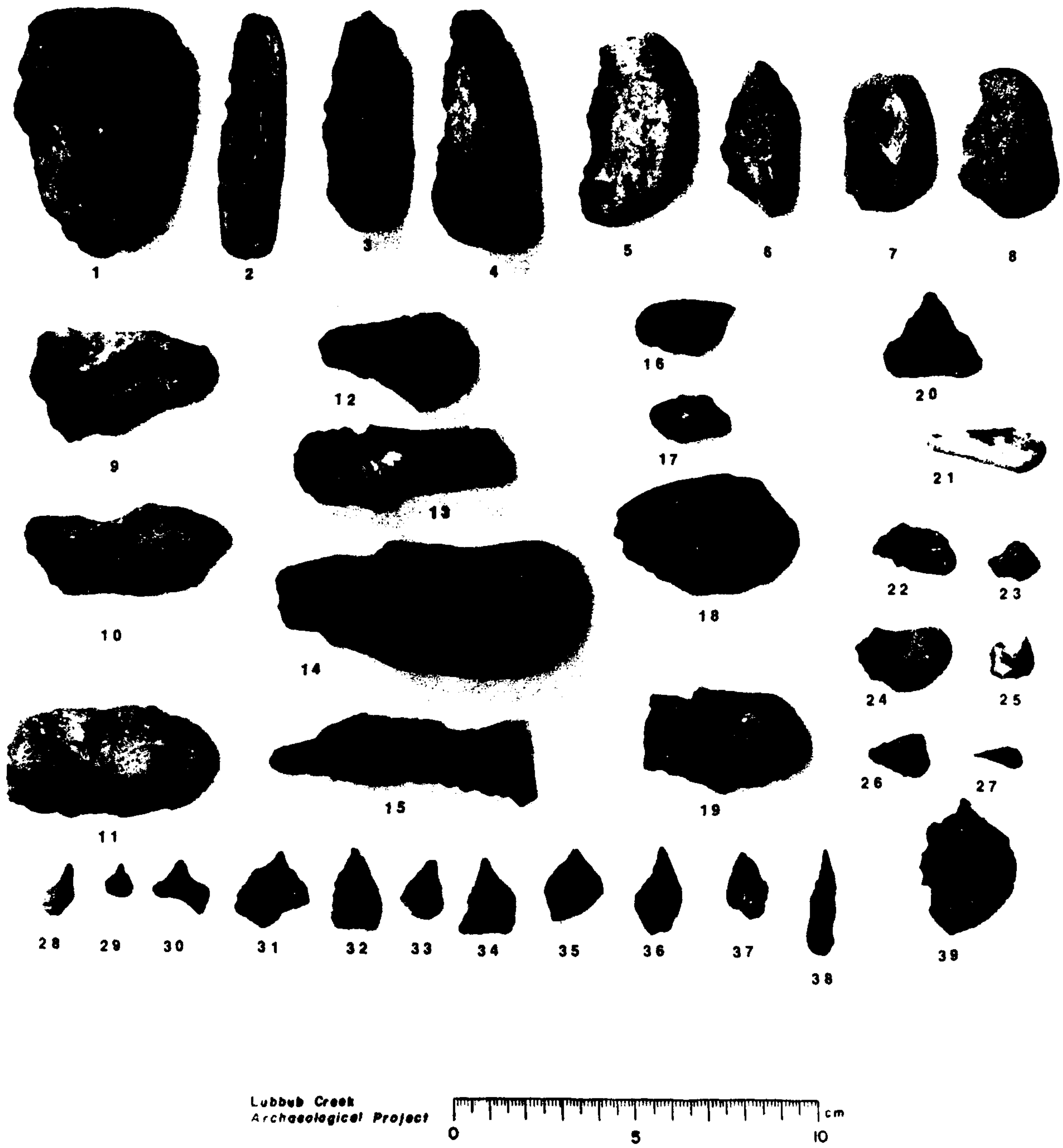

Figure 9. Bifacial Tools from the Lubbub Creek Archaeological Locality: 1-8, Longitudinal Edge Flaked Cobbles; 9-11, Transverse Edge Flaked Cobbles; 12-14, 19, Chisel Edge Cobbles; 15, Chisel Bit on Preform; 16-18, Worked Flakes; 20, Perforator-Graver: 21-27, Flaked Gravel; 28-39, Perforator-Gravers.

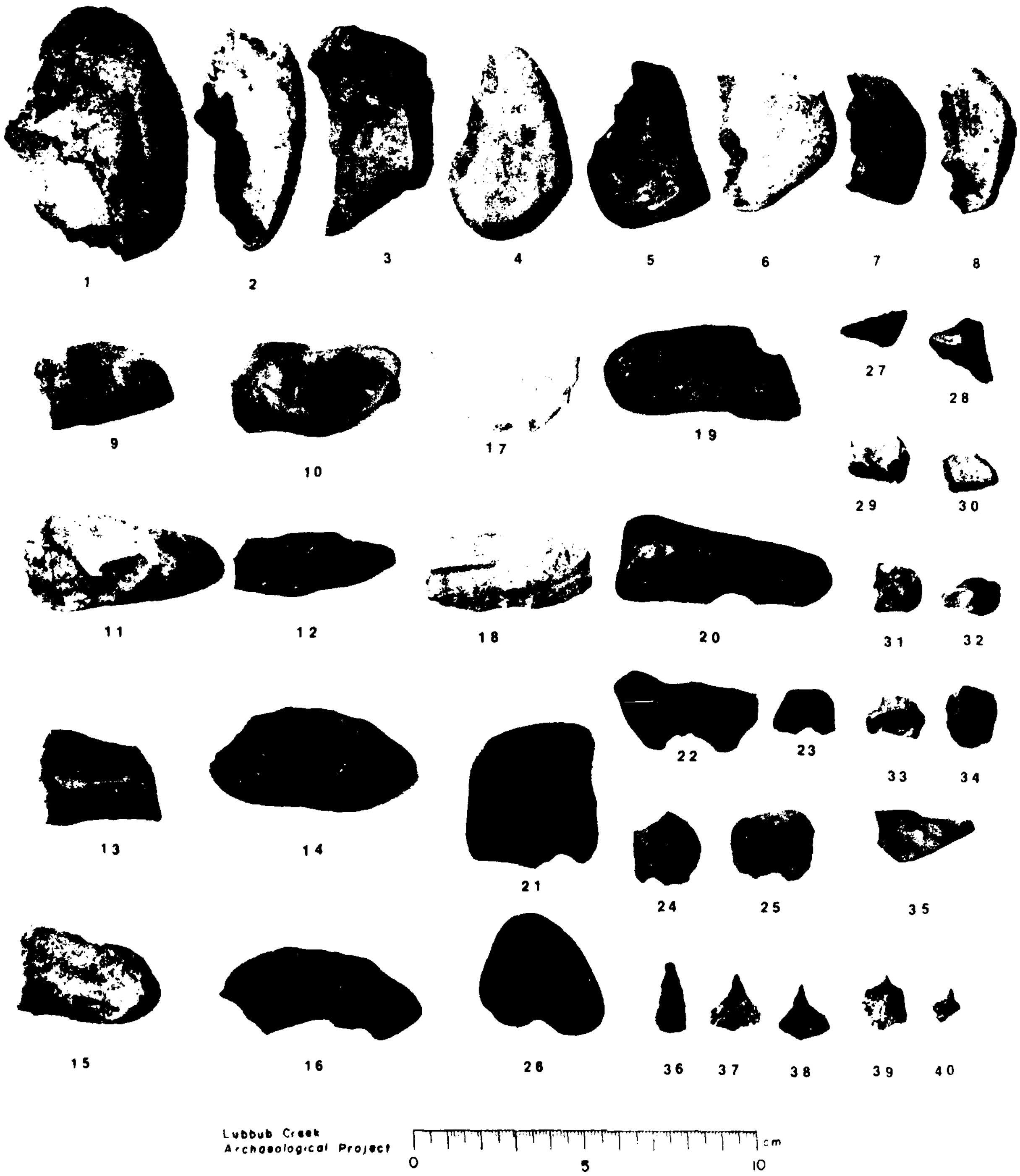

Figure 10. Unifacial Tools from the Lubbub Creek Archaeological Locality: 1-8, Longitudinal Edge Flaked Cobbles; 9-16, Transverse Edge Flaked Cobbles: 19-22, 24-26, Concave Scrapers; 27-28, Worked Flakes; 36-40, Perforators and Gravers.

fragments came from throughout the area of the Phase II and III excavations.

Miscellaneous Greenstone

A small greenstone "pendant," which actually was a prehistoric guitar pick (Figure 11:19), was found in a plowzone sample in Hectare 400N/-300E. This object has the beginnings of a small hole drilled into its small end.

A total of 35 greenstone fragments was recovered from various parts of the site. Almost all these fragments which can be assigned a chronological position seem to have come from the later part of the Mississippian period.

A greenstone bar gorget (Figure 11:18) was recovered from a protohistoric structure in Hectare 500N/-300E.

Discoidals, N=11 (Figure 12:1-9).

These thick, round stone discs usually are called "Chunkee Stones." In addition to the nine complete specimens shown in Figure 12, two "preforms" were recovered to make the total of eleven discoidals. Both preforms were made from hematite; the complete discoidals comprised one greenstone, two fossiliferous limestone, three hematite, and three sandstone examples. Two discoidals, one limestone and one hematite, were found in a protohistoric, Summerville IV structure.

Miscellaneous Hematite Artifacts

One small lump of hematite has a grid of lines scratched into one of its faces (Figure 11:16). Another piece of hematite had been worked into a "plumet" (Figure 11:17). Several thousand small pieces of hematite, most of which were probably inclusive in the deposits of the river bend, were found throughout the Lubbub Creek Archaeological Locality. Approximately 30 of these small nodules had been faceted, and they probably were the only artifacts among the much larger number of hematite pieces.

Sandstone Disc Fragments, N=33 (Figure 12:a, b, c).

All but one of the thirty-three sandstone disc fragments were recovered in one 10 x 10 m unit in Hectare 400N/-300E. This distribution suggests that if not part of the same disc, they at least came from the same Summerville II and III period feature-complex, Structure 7.

'te Vessel Fragments, N=13 (Figure 12:d).

l but one of the thirteen steatite vessel fragments were found in a singl 10 x 10 m unit in Hectare 300N/-300E. The thirteenth sherd was rec ..ed from a Mississippian structure in Hectare 400N/400E.

MET L ARTIFACTS

Approximately 20 kg of iron were recovered from various excavation units located west of the mound. For the most part, these iron artifacts were in the plowzone, and their distribution suggests that they were spread from the top of the mound when it was bulldozed in the 1950s. Other than what appears

TABLE 4

Contents[1] of Flotation Samples from Miller III Period Pits, Lubbub Creek Archaeological Locality.

Identification	Pits N=37 Samples							
	Count	Weight (g)	Mean Count/Liter (g)	S.D	Mean Weight/Liter	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
<u>Carya</u> sp. (hickory)	1,046	20.01	6.390	10.684	0.110	0.181	35	94.6
<u>Carya illinoensis</u> (pecan)	7	0.11	0.016	0.097	a	0.002	1	2.7
Juglandaceae	p	p	p	-	p	-	5	13.5
<u>Juglans nigra</u> (walnut)	1	0.18	0.027	0.164	0.005	0.304	1	2.7
<u>Quercus</u> sp. (acorn)	1,135	6.04	9.465	41.041	0.051	0.222	28	75.7
Total Nutshells	2,189	26.34	15.897	43.289	0.166	0.306	35	94.6
Nutmeats								
<u>Quercus</u> sp. (acorn)	1	0.06	0.002	0.014	a	0.001	1	2.7
Corn								
<u>Zea mays</u> kernels	3	0.01	0.007	0.041	a	a	2	5.4
cupules	3	0.05	0.036	0.172	0.001	0.003	6	16.2
glumes	1	0.01	0.005	0.027	a	a	2	5.4
embryos	1	0.01	0.002	0.014	a	a	1	2.7
Total <u>Zea mays</u>	8	0.08					9	24.3
Wood Charcoal	2,564	34.67	19.376	24.023	0.234	0.312	37	100.0
Bark	189	2.44	1.698	2.430	0.017	0.076	25	67.6
Cane	2	0.02	0.018	0.110	0.001	0.001	1	2.7
Pine Cone fragments	p	p	p	-	p	-	1	2.7
Seeds	7	0.13	-	-	-	-	8	21.6
Insect Galls	8	0.07	0.072	0.316	a	0.003	2	5.4
Unidentified	386	2.50	-	-	-	-	36	97.3
TOTAL	5,354	66.31	40.066	61.575	0.441	0.572		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fractions; "a" indicates less than 0.001

Miller III period:

A substantially larger number of flotation samples were available from Miller III contexts: thirty-seven from pits and two from smudge pits. The two smudge pits, Pits 12 and 13 in Hectare 500N/-200E, were located on the pre-mound surface and appeared to be contemporary with Structure 4, a Late Woodland structure. The flotation samples from pits were from zones of two stratified pits, Pits 25 and 28 in Hectare 400N/-500E, from zones of five stratified pits (Pits 9, 20, 22, 32, and 33) and from four other pits (Pits 21, 23, 24, and 34) in Hectare 300N/-300E. Tables 4 and 5 summarize the flotation sample data for the Miller III features.

Several items occurred in the samples from the Miller III period that were not present in the earlier samples. These items include acorn and walnut shells, and maize kernels and cupules. Eight insect galls were present in the Miller III samples. Although these galls could have been brought in with firewood, insect galls could have been eaten, as they are eaten today in Mexico (C.E. Smith, personal communication).

Nuts were still the predominant plant food remain in the Miller III pits, but maize occurred at low frequencies in over half of the pits. Acorn remains outnumbered hickory, although the hickory nutshells recovered weighed over three times as much as the acorn shells.

Two smudge pits assigned to the late Miller III period contained large quantities of maize cob fragments and pine cones. Both smudge pits contained pine seeds and, one (Pit 13, USN 8968) also contained a <u>Chenopodium</u> seed, an <u>Iva annua</u> seed, and grass seeds. If the pine cones were collected just prior to their use, these pits were probably used in the fall. The pine seeds appeared to be loblolly pine (<u>Pinus taeda</u>), whose cones ripen in September to October and disperse their seeds from October to December (Schopmeyer 1974). The cones were apparently collected after their seeds had matured but before the seeds were dispersed.

<u>Mississippian Period</u>

Most of the features from the Lubbub Creek Archaeological Locality were attributed to the Mississippian period. Some could be confidently assigned to the early Mississippian Summerville I period, others to the Mature Mississippian Summerville II and III periods, and others to the Protohistoric Summerville IV period. Those features which did not clearly belong in groups assigned to these periods will be discussed in this report as general Mississippian.

Summerville I period:

Forty-four flotation samples were analyzed from Summerville I contexts. Around one-half of these were from structures: Structures 1 and 2 on the pre-mound surface in Hectare 500N/-300E, Structure 5C on the pre-mound surface in Hectare 500N/-200E, and Structure 1 in Hectare 500N/-400E. Seven of the samples were from hearths: six from zones of Hearth 1 in Hectare 500N/-400E, associated with Structure 1, and one from the central hearth of Structure 1 on the pre-mound surface.

TABLE 3

Contents[1] of Flotation Sample from Miller I Period Feature, Lubbub Creek Archaeological Locality.

Identification	Pits N=1			
	Total Count	Total Weight (g)	Mean Count/Liter	Mean Weight/Liter (g)
Nutshells				
Carya sp. (hickory)	26	0.39	8.567	0.130
Quercus sp. (acorn)	4	0.03	1.333	0.010
Total Nutshells	30	0.42	10.000	0.140
Wood Charcoal	12	0.16	4.000	0.053
Bark	p	p	p	p
Unidentified	p	p	p	p
TOTAL	42	0.58	14.000	0.193

[1]Contents of >2 mm fraction except for number of occurrences which is for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fraction.

TABLE 2

Contents[1] of Flotation Samples from Gulf Formational Period Artifact Concentrations, Lubbub Creek Archaeological Locality.

Identification	Artifact Concentrations N=2 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrence	Percent Occurrence
Nutshells								
Carya sp. (hickory)	4	0.05	2.333	2.357	0.033	0.038	2	100.0
Juglandaceae	p	p	p	-	p	-	1	50.0
Total Nutshells	4	0.05	2.333	2.357	0.033	0.038	2	100.0
Wood Charcoal	11	0.14	7.667	8.957	0.115	0.148	2	100.0
Unidentified	1	0.01	-	-	-	-	2	100.0
TOTAL	16	0.20	10.167	11.078	0.150	0.184		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fraction.

TABLE 1

Contents[1] of Flotation Samples from Gulf Formational Period Pits, Lubbub Creek Archaeological Locality.

Identification	Pits N=2 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Juglandaceae	p	p	p	-	p	-	1	50.0
Wood Charcoal	1	0.01	0.167	0.236	0.002	0.002	2	100.0
Bark	p	p	p	-	p	-	1	50.0
Unidentified	p	p	p	-	p	-	2	100.0
TOTAL	1	0.01	0.167	0.236	0.002	0.002		

[1]Contents of >2 mm fraction, except number c occurrences and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in >2 mm fraction.

however, could be sorted only to the Juglandaceae, the family which includes the hickories, pecans, and walnuts. Considering the paucity of pecan and walnut shells, most of the nutshells assigned to the Juglandaceae were probably hickory.

Seed identification manuals (Martin and Barkley 1961; Landers and Johnson 1976; Musil 1963; Schopmeyer 1974), personal reference collections, and the University of Alabama Herbarium specimens were used for the identification of plant remains.

PLANT REMAINS

The contents of 319 flotation samples which comprised 1,137 liters of soil provided the major set of data for analysis. These samples came from 175 features: 97 pits (157 samples), 31 smudge pits (38 samples), 11 structures (80 samples), 7 hearths (15 samples), and 29 other proveniences (29 samples). A total of 190,141 fragments of charred plant remains were sorted; in total they weighed 2,178 grams. An additional 1,345 grams of charcoal, from the fractions which passed through the 2 mm screen, were scanned. Only 1.6 percent of the total number of fragments larger than 2 mm from flotation samples (1 percent of the total weight) was unidentified. Plant remains from waterscreened samples from these proveniences weighed 1,518 grams. The results of the analyses of all these remains have been divided into cultural and chronological periods for the purpose of presentation and discussion.

The whole of these data are presented in Appendix H of Volume III.

Gulf Formational Period

Four flotation samples were analyzed from Gulf Formational period contexts: two from Zones A and B of Pit 1, one from Artifact Concentration 2, and one from Artifact Scatter 3, all of which were located in Hectare 400N/-500E. Pit 1 and Artifact Scatter 3 were attributed to the earlier, Broken Pumpkin Creek phase, and Artifact Concentration 2 to the later, Henson Springs phase.

Plant remains from this period were sparse; the only food represented was hickory nuts. Wood charcoal and bark were also present. Only wood and hickory nutshells were present in the waterscreened sample. Tables 1 and 2 list data for the flotation samples. On the basis of the scanty data from this period, no conclusions can be drawn concerning subsistence.

Woodland Period

Miller III Period:

Plant remains were analyzed from a single Miller I feature -- Pit 25 in Hectare 300N/-300E. This pit contained hickory and acorn nutshell fragments, wood charcoal, and bark. Data for this feature are reported in Table 3. Again, the sparse amount of remains from this period precludes any attempt to describe subsistence other than to say that the fall nut crops were utilized.

were processed.

The analysis centered on the flotation samples; earlier investigations (Caddell 1979) showed that the contents of waterscreened samples were heavily skewed by differential recovery of the larger, more durable plant remains. The flotation samples contained the full size range of botanical debris and were particularly valuable for recovering small seeds. The quarter-inch waterscreened samples were used to supplement the data from the flotation samples.

The light fractions of the 870 flotation samples weighed over 14,500 grams. Only a sample of this total could be analyzed in the time allotted.

Of top priority for analysis were samples which could be securely dated either by ceramic or radiometric methods. The Lubbub Creek Archaeological Locality was occupied continuously for several hundred years, and later features often contained earlier debris. This hindered our attempts to place certain features in chronological positions. Those which could be assigned with confidence were selected first. Smudge pits could rarely be attributed to a particular occupation, but could usually be assigned to the Mississippian period. Some other features with less secure cultural affiliations were thought to be important and were also analyzed. The final corpus of botanical material for analysis comprised 319 flotation samples.

If the light fractions contained fragments of pottery, bone, shell, or lithics, they were chemically floated in a zinc chloride solution (Struever 1968). Likewise, if charcoal was present in the heavy fractions, these fractions were also floated. After the samples dried, modern seeds and rootlets and other contamination were removed. The samples were sifted through a set of geological screens which divided the remains into three size fractions: larger than 2 mm, 1-2 mm, and 0.355-1 mm.

The whole of the fraction which did not pass through the 2 mm screen was sorted, counted, and weighed. The two smaller fractions were scanned and components noted on a presence/absence basis with the exception of carbonized seeds. Most of the carbonized seeds occurred in the smaller fractions, and an exact count was recorded for these seeds. Otherwise, it is very time-consuming to sort the pieces which are smaller than 2 mm, and identifications are not as reliable as for the pieces which are larger than 2 mm.

The large amount of charcoal present in 28 samples made subsampling necessary. Twenty of these samples were from smudge pits. To obtain a subsample, the charcoal was poured into a box with a grid -- pouring was done across the box, and charcoal was counted out from top to bottom, starting in a corner of the box. One hundred fifty pieces were counted. If, however, this did not comprise at least five percent of the sample by weight, additional pieces were counted so that at least five percent of each sample was analyzed. The portion which was not sorted was scanned; if there were components in the remainder which did not occur in the subsample, an exact count was recorded for each. All seeds were also pulled from the remainder. Counts and weights of each component in the entire large fraction were estimated on the basis of their counts and weights in the subsample.

Nutshells were sorted to the genus level when possible. Some nutshells,

Lubbub Creek Archaeological Locality.

Excavations of five sites in the central Tombigbee River valley in 1976 and 1977 yielded additional plant remains (Caddell 1979). These seasons marked the first time that botanical remains from sites in the valley were systematically collected by both flotation and waterscreening. The majority of samples were from Woodland contexts. The contents of these samples indicated that gathered resources formed the major portion of the diet throughout the Woodland period. Although maize was present in the Late Woodland Miller III samples, it apparently was not used heavily; and the few Mississippian samples that were analyzed indicated that corn did become a main carbohydrate source. Gathered resources were represented in the Mississippian samples, but their importance could not be assessed. The sample from Mississippian contexts was small and was comprised almost entirely of the contents of corn cob-filled smudge pits.

Sheldon (1974) summarized the sparse botanical data from "Burial Urn" sites in central Alabama and suggested that the basic subsistence pattern changed little from the early Mature Mississippian through the Protohistoric period. However, he did not "rule out quantitative shifts in the respective contributions of agricultural and wild foodstuffs to the diet" (ibid:82).

The sample reported and analyzed here from the Lubbub Creek Archaeological Locality was drawn from a variety of proveniences and from a long cultural sequence. Because most of the samples are attributed to the Late Woodland, Mississippian, and Protohistoric occupations, interpretations will concentrate on the nature of subsistence patterns during these times. With this sample, we should be able to describe the changes in plant utilization which occurred as the populations at this locality made the transition from a gathering to a mixed gathering and agricultural economy. The conclusions drawn by the researchers discussed above will be evaluated with respect to the data from the Lubbub Creek Archaeological Locality.

RECOVERY AND LABORATORY PROCESSING OF PLANT REMAINS

During excavation, constant volume (3 liter) flotation samples were taken from each pit or pit zone, each structure cut or level, each hearth, from midden areas, and from other proveniences selected by the excavators. All dirt from features not processed by flotation was waterscreened through a one-quarter inch (6.3 mm) and a one-sixteenth inch (1.6 mm) mesh screen. Flotation samples were processed by water flotation in a machine similar to the SMAP machine described by Watson (1976). Muslin bags with openings of less than 0.1 mm caught the botanical remains which floated (the light fraction), and the heavier material was caught in a one-sixteenth inch (1.6 mm) mesh screen.

Some flotation samples which had a high density of botanical remains or which contained fragile corn cobs were brought to the field laboratory to be floated by hand. Most of these samples were from "smudge pits" similar to those described by Binford (1967). Preliminary processing of the botanical remains also took place in the field laboratory. All botanical material recovered in the quarter-inch waterscreen was sorted and weighed. The light fractions of the flotation samples were weighed, then the light and heavy fractions were bagged separately. Eight hundred seventy flotation samples

CHAPTER 3. FLORAL REMAINS FROM THE LUBBUB CREEK ARCHAEOLOGICAL LOCALITY

Gloria M. Caddell

Excavations in the Lubbub Creek Archaeological Locality produced a large sample of systematically recovered plant remains. Although samples were sparse from earlier contexts, a substantial record of plant utilization was available for the Late Woodland, Mississippian, and Protohistoric periods.

Some information on subsistence patterns of late prehistoric populations was available from both ethnographic and archaeological sources. The earliest ethnographic sources indicate that the southeastern Indian populations grew and stored large quantities of maize. The De Soto expedition depended on the stored supplies of maize -- the Gentleman of Elvas, travelling with De Soto through the general area in 1540, remarked that the land "was thickly inhabited...and as it was fertile, the greater part being under cultivation, there was plenty of maize. So much grain was brought together as was needed for getting through with the season" (quoted in Smith 1866:92).

Other ethnographic references compiled by Swanton (1946) and Yanovsky (1936) attest to the fact that wild foodstuffs were never abandoned in favor of cultivated plants, however. Subsistence information for the Choctaw (Swanton 1931; Campbell 1959), a tribe geographically close to the study area, indicates that they used a great variety of wild plant food resources in addition to the crops they cultivated.

Data from archaeological sites have indicated that the Mississippian societies derived a large portion of their food requirements from cultivated plants. Mississippian societies have been characterized as those "which developed a dependence upon agriculture for their basic, storable food supply" (Griffin 1967:189). Ford (1974:408) suggested that "the Mississippian ecosystem was a simplified food base with agriculture the dominant mode of production supplemented by continued hunting and collecting."

Earlier excavations in the central Tombigbee River valley provided information on the nature of prehistoric subsistence patterns, particularly for the Woodland period. Plant remains from excavations in 1974 were identified by C.E. Smith (1975). Although he cautioned that the recovery techniques (all botanical remains were recovered in a quarter-inch waterscreen) may have resulted in a loss of many types of plant remains, differences between Woodland and Mississippian samples were evident. Woodland period samples consisted almost entirely of hickory nutshells, but Mississippian samples were predominately maize fragments. Smith suggested, however, that the importance of gathered resources may have been greater than the samples indicated. This study also provided the first archaeological evidence of the common bean in Alabama; 27 beans were identified by Smith from a Mississippian postmold excavated at Site 1Pi12, a site located within the

TABLE 8

(Continued)

	Miller III	Mixed Miller III Mississippian	Summerville					
			I	II and III	Mound	I to III	IV	IV Ditch
OTHER								
Blade	4	1						
GROUNDSTONE								
Ind. Sandstone	15	32	3	7	1	8	3	11
Ind. Hematite		3		6		4	9	3
Steatite Vessel Sherd	10[1]	1					1	
Grooved Sandstone	2	3	1	5		3	3	3
Disc Fragment		6[1]		22[1]		1		
Discoidal							2	
Pitted Stone		1		1				
Hammerstone		1						1
Quartzite				1				
Celts					2			
Incised Hematite				1				
Greenstone Fragments		2		3	3	5	1	1
Mica Fragments					6[1]			

[1]Each of these fragments comes from a single artifact.

TABLE 8

Lithic Artifacts with Chronological Associations

	Miller III	Mixed Miller III Mississippian	Summerville					
			I	II and III	Mound	I to III	IV	IV Ditch
CORES								
Primary	3	3		2	1			
Secondary	7	3	2	4		6	1	2
Blade						2		1
Fragment	1	2						
Bipolar Wedge								1
UNIFACE								
Transverse Edge Cobble					1		2	
Longitudinal Edge Cobble		1		1				
Perforator-Graver				1	1			
Concave Scraper				1		1		
Worked Flake						2		
Miscellaneous	1	1	5	1	1	3	1	8
BIFACE								
Blank					1			
Triangular Preform	2		3		1	1	2	1
Projectile Point	13	8	5	5	6	12	2	8
Thin Preform		1						
Drill Preform	2	1				1	1	
Drill	1	1		1	2	4	2	1
Micro-Drill					1	1		
Transverse Edge Cobble						1		
Longitudinal Edge Cobble					1			
Perforator-Graver	1		1		1		1	
Worked Flake							2	
Tool Fragment								1
Miscellaneous	8	6	5	5	2	5	5	5

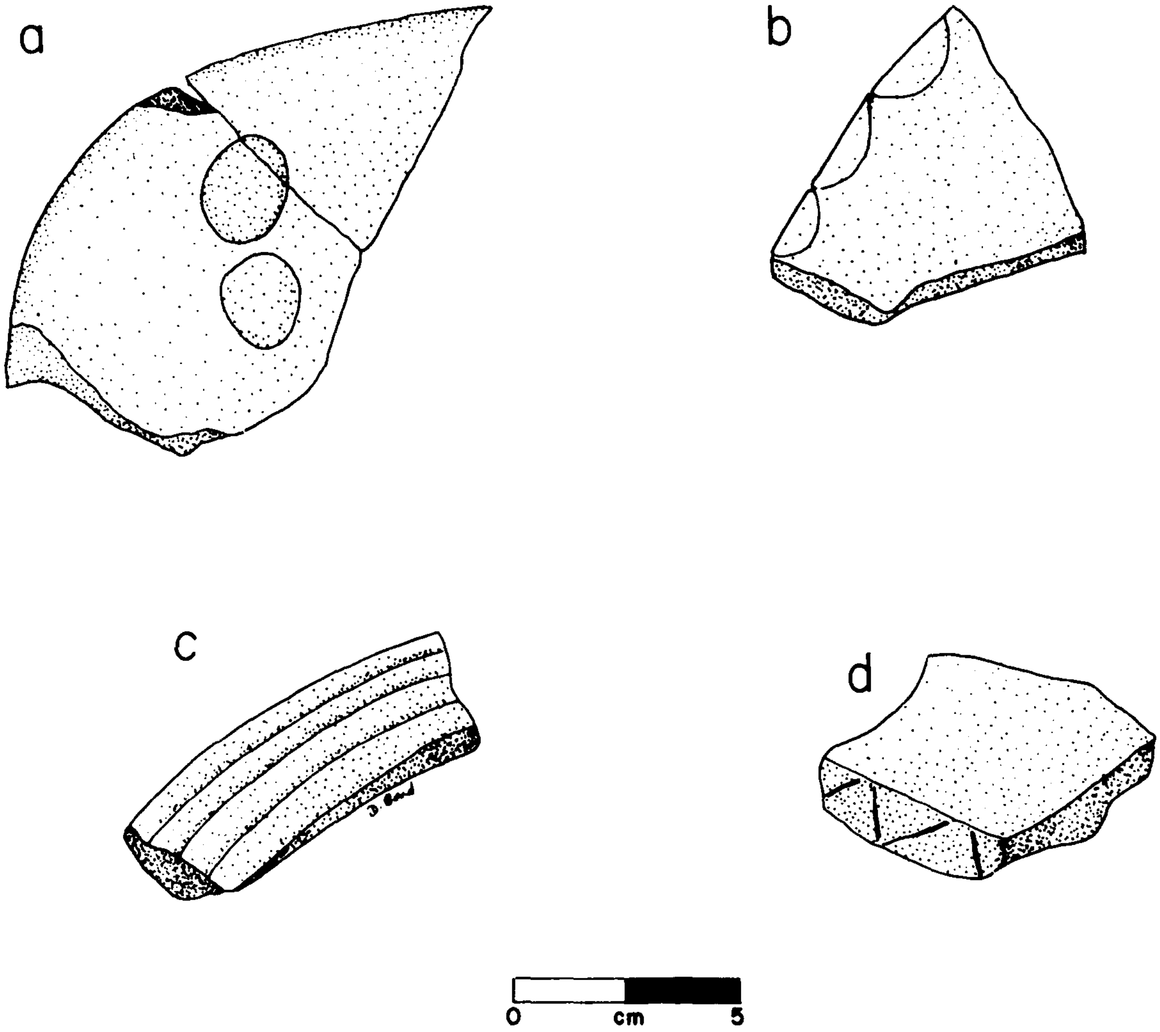

Figure 12. Groundstone Discs, a-c, and Steatite Vessel Fragment, d.

Figure 11. Ground Stone Artifacts from the Lubbub Creek Archaeological Locality: 1-9, Discoidals; 10-15, Celts and Celt Fragments; 16, Engraved Hematite; 17, Hematite Plumet; 18, Bar Gorget Fragment; 19, Greenstone Fragment.

to be a spur, the iron artifacts were late nineteenth and early twentieth century trash: nails, barbed wire, and scrap metal.

Two galena cubes were recovered from two separate plowzone samples: one in Hectare 500N/-300E, the other in 400N/-300E. One musket ball was found in the plowzone near the mound.

Two copper bicymbal ear spools were found with Burial 6 in Hectare 400N/-400E. This burial was the one that had the terraced ceremonial bowl and the four identical projectile points as grave goods. One ear spool was located on either side of the skull, and each one had a small bone needle, preserved by the copper salts, which probably served to attach the spools.

FUNCTIONAL AND CHRONOLOGICAL CONSIDERATIONS

It should be apparent at this point that lithic tools played a very small role in the life of the Mississippian communities in the Lubbub Creek Archaeological Locality. Cane, wood, and perhaps bone rather than stone must have served as the raw materials used to make tools.

Given the low numbers of stone tools in contrast to the number of excavated features, it is hard to construct tool kits or otherwise take the analyses of these lithics beyond their form and general distribution within the river bend. The average weight of each of the several categories of unmodified lithics (cores, flakes, etc.) is less than 1 gram per pit or structure cut. What limited numerical structure there is in 516 pits and pit levels does suggest a division into four groups of unmodified lithic artifacts: 1) primary and secondary decortication flakes, bifacial thinning flakes, other flakes, and amorphous flakes; 2) blades and blade-like flakes; 3) utilized flakes; and 4) primary cores. This four-fold division is at best suggestive rather than real; it is the result of a statistically quite illegitimate principal component analysis of the weights of these lithic categories per pit.

Few finished stone tools were found in fewer features with secure chronological context (Table 8). The Miller III materials came from eight pits; the mixed Miller III and Mississippian features encompassed only two features. The Summerville I tools came from one structure and three pits; the Summerville II and III stone tools were contained in one structure, six pits, and one midden. The Summerville I material from the mound was found in the structure on the pre-mound surface and in two middens on the mound slope. The artifacts from the Summerville IV period were located in one structure and one pit plus the ditch.

Even when mixing of chronologically different deposits is considered, there are a few trends in these data. Steatite vessel fragments are found in a single, later Miller III component, and unretouched blades do seem to be restricted to the Miller III period. Greenstone artifacts, including celts, stone disc fragments, and discoidals are restricted to the Mississippian, and mica is limited to the Mississippian mound deposits. Otherwise, most finished tool categories are distributed among all the periods of the Late Woodland and Mississippian.

TABLE 5

Contents[1] of Flotation Samples from Miller III Period Smudge Pits, Lubbub Creek Archaeological Locality

Identification	Smudge Pits N=2							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrence	Percent Occurrence
Corn								
Zea mays kernels	4	0.03	0.333	0.471	0.003	0.004	1	50.0
cupules	11,786	227.18	788.688	526.353	14.651	15.612	2	100.0
glumes	1,280	3.28	106.040	144.660	0.267	0.325	2	100.0
cobs	22	27.47	1.396	1.738	1.752	2.087	2	100.0
Total *Zea mays*	13,092	257.96					2	100.0
Wood Charcoal	1,769	81.15	118.460	78.194	5.121	6.688	2	100.0
Grass Stems	1	0.01	0.083	0.118	0.001	0.001	1	50.0
Pine Cone Fragments	24,968	171.16	2,017.500	2,317.600	13.430	11.922	2	100.0
Seeds	102	0.53	-	-	-	-	2	100.0
Unidentified	298	5.05	-	-	-	-	2	100.0
TOTAL	40,230	515.86	3,058.958	1,969.100	35.580	12.548		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions.

The contents of two smudge pits assigned to this period were analyzed: Pit 36 in Hectare 300N/-300E and Pit 10 in Hectare 500N/-400E. Seven samples were from other pits: Pit 14 in Hectare 300N/-300E, Pits 4 and 97 in Hectare 400N/-300E, Pit 67 in Hectare 600N/-400E, Pits 9 and 11 in Hectare 500N/-400E, and Pit 4, associated with Structure 1 on the pre-mound surface in Hectare 500N/-300E. Samples from four other proveniences were analyzed: the Palisade in Hectare 400N/-300E, a midden in Hectare 400N/-300E, a daub concentration in Hectare 600N/-400E, and a burned area within Structure 1 in Hectare 500N/-400E. Data for pits, smudge pits, structures, and hearths are summarized in Tables 6-9.

The botanical remains in the Summerville I pits were similar to those in the earlier Miller III pits, but the proportions were quite different. In Summerville I pits, maize remains far outnumbered nutshells. Only seven percent of the food plant remains were nutshells, compared to 93 percent maize remains. Also, of the total nut remains from all features, over 91 percent were hickory and around eight percent were acorn.

There were few plant food remains from structure cuts or levels. Only 11 nutshell fragments and four fragments of maize were identified in 21 samples.

Wood charcoal, not surprisingly, was the most frequent plant remain in hearths. Nutshells and maize fragments were also present. Zones A and D of Hearth 1 in Hectare 500N/-400E contained nine sunflower seeds (Helianthus annuus).

Smudge pits assigned to the Summerville I period contained maize cob fragments and wood charcoal, and lesser quantities of bark, cane, and nutshell fragments.

Summerville II and III periods:

Thirty-seven flotation samples were analyzed from Summerville I or III contexts. Thirty-two were from pits: Pit 26 in Hectare 300N/-200E, Pit 13 in Hectare 400N/-500E, Pits 1, 7, 11, 20, 21, 28, and 50 in Hectare 400N/-400E, Pits 8, 124, 141, 144, 146, 150, 157, and 163 in Hectare 400N/-300E, Pits 4, 16, 38, and 45 in Hectare 500N/-400E, Pit 1 in Hectare 500N/-300E, and Pits 14 and 98 in Hectare 600N/-400E. Five other samples were analyzed: two from 1 x 1 m excavation units in Hectare 300N/-300E, one from a smudge pit, Pit 58, in Hectare 400N/-400E, one from a cut of Structure 6 in Hectare 400N/-300E, and one from Hearth 1 in Hectare 300N/-300E. Tables 10, 11, and 12 summarize the contents of flotation samples from pits, the hearth, and the smudge pit from these periods.

The proportions of food plant remains in Summerville II and III pits were similar to those from the Summerville I period. Maize was the predominant plant food remain; nuts formed only three percent of the plant food remains by count; and hickory nutshells were much more frequent than acorn.

One particularly interesting feature was Pit 26 (USN 2896) in Hectare 300N/-200E. Over 22,000 maize kernels or fragments were recovered from this feature. Cupule fragments were present, but their number was too low for them to have contained all the kernels present. Passionflower, Chenopodium, sedge, maygrass, and sage seeds were also identified from this feature; also present

TABLE 6

Contents[1] of Flotation Samples from Summerville I Period Pits, Lubbub Creek Archaeological Locality.

Identification	Pits N=7 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	8	0.08	0.381	0.621	0.004	0.006	3	42.9
Quercus sp. (acorn)	4	0.04	0.190	0.262	0.002	0.003	4	57.1
Total Nutshells	12	0.39	0.571	0.568	0.006	0.006	5	71.4
Corn								
Zea mays cupules	132	1.75	6.286	16.191	0.083	0.218	3	42.9
glumes	26	0.09	1.238	3.276	0.004	0.011	1	14.3
cobs	2	1.37	0.095	0.252	0.065	0.173	1	14.3
Total *Zea mays*	160	3.21					3	42.9
Wood Charcoal	228	2.35	10.857	12.943	0.012	0.177	7	100.0
Bark	54	0.49	2.571	6.373	0.023	0.059	4	57.1
Pine Cone Fragments	2	0.03	0.095	0.163	0.001	0.003	2	28.6
Seeds	1	0.02	-	-	-	-	1	14.3
Unidentified	4	0.02	-	-	-	-	6	85.7
TOTAL	461	6.24	21.952	22.527	0.297	0.408		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions.

TABLE 7

Contents' of Flotation Samples from Summerville I Period Structures, Lubbub Creek Archaeological Locality.

Identification	Structures N=21 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	10	0.11	0.135	0.323	0.002	0.017	8	38.1
Juglandaceae	1	0.03	0.016	0.073	a	0.002	2	9.5
Quercus sp. (acorn)	p	p	p	-	p	-	2	9.5
Total Nutshells	11	0.14	0.151	0.324	0.002	0.004	12	57.1
Corn								
Zea mays kernels	1	0.02	0.016	0.073	a	0.001	1	4.8
cupules	3	0.04	0.024	0.080	a	0.001	6	28.6
embryos	p	p	p	-	p	-	1	4.8
Total *Zea mays*	4	0.06					6	28.6
Wood Charcoal	304	3.22	3.492	4.053	0.041	0.073	21	100.0
Bark	34	0.29	0.310	0.757	0.003	0.005	16	76.2
Grass Stems	p	p	p	-	p	-	4	19.0
Cane	p	p	p	-	p	-	1	4.8
Pine Cone Fragments	19	0.08	0.151	0.431	0.001	0.002	7	33.3
Seeds	p	p	-	-	-	-	6	28.6
Unidentified	30	0.16	-	-	-	-	19	90.5
TOTAL	402	3.95	4.381	4.516	0.048	0.076		

Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fraction, but not in the >2 mm fraction; "a" indicates less than 0.001.

TABLE 8

Contents[1] of Flotation Samples from Summerville I Period Hearths, Lubbub Creek Archaeological Locality.

Identification	Hearths N=7 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp (hickory)	43	0.57	0.847	1.274	0.012	0.017	6	85.7
Quercus sp (acorn)	5	0.05	0.067	0.111	0.001	0.001	4	57.1
Total Nutshells	48	0.62	0.914	1.261	0.012	0.017	7	100.0
Corn								
Zea mays kernels	9	0.15	0.197	0.232	0.003	0.004	5	71.4
cupules	18	0.13	0.241	0.522	0.002	0.003	2	28.6
glumes	p	p	p	-	p	-	2	28.6
embryos	1	0.01	0.010	0.027	a	a	1	14.3
Total *Zea mays*	28	0.29					6	85.7
Wood Charcoal	1,511	13.37	22.972	30.512	0.205	0.278	7	100.0
Bark	24	0.22	0.396	0.376	0.004	0.003	5	71.4
Cane	1	2.20	0.024	0.063	0.052	0.139	1	14.3
Pine Cone Fragments	p	p	p	-	p	-	1	14.3
Seeds	10	0.04	-	-	-	-	3	42.9
Unidentified	65	0.45	-	-	-	-	7	100.0
TOTAL	1,687	17.19	26.041	30.384	0.286	0.290		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in >2 mm fraction; "a" indicates less than 0.001

TABLE 9

Contents[1] of Flotation Samples from Summerville I Period Smudge Pits, Lubbub Creek Archaeological Locality.

Identification	Smudge Pits N=2							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	39	0.39	6.500	9.912	0.065	0.092	1	50.0
Quercus sp. (acorn)	p	p	p	-	p	-	1	50.0
Total Nutshells	39	0.39	6.500	9.192	0.065	0.092	1	50.0
Corn								
Zea mays kernels	16	0.13	5.667	4.714	0.052	0.054	2	100.0
cupules	2,800	28.58	671.670	80.139	7.140	0.014	2	100.0
glumes	466	1.58	111.000	15.556	0.353	0.118	2	100.0
cobs	15	7.04	7.500	10.607	3.520	4.978	1	50.0
Total *Zea mays*	3,297	37.33					2	100.0
Wood Charcoal	1,132	13.99	526.670	689.190	6.558	8.657	2	100.0
Bark	13	0.13	2.167	3.064	0.022	0.031	1	50.0
Cane	76	0.01	36.667	49.969	1.250	1.740	2	100.0
Seeds	p	p	-	-	-	-	1	50.0
Unidentified	51	0.18	-	-	-	-	2	100.0
TOTAL	4,608	54.56	1,393.300	682.590	19.050	15.302		

[1]Contents of 2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm and <1 mm) fractions, but not in >2 mm fraction.

TABLE 10

Contents[1] of Flotation Samples from Summerville II and III Pits, Lubbub Creek Archaeological Locality.

Identification	Pits N=32 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	728	13.94	8.912	25.606	0.279	1.157	26	81.3
Juglandaceae	p	p	p	-	p	-	1	3.1
Quercus sp. (acorn)	46	0.43	1.287	6.345	0.013	0.067	17	53.1
Fagus grandifolia (beech)	p	p	p	-	p	-	1	3.1
Total Nutshells	774	14.37	10.198	31.379	0.292	1.223	30	93.8
Juglandaceae nutmeats	8	0.11	0.135	0.534	0.002	0.007	2	6.3
Corn								
Zea mays kernels	22,477	215.22	39.387	220.440	0.383	2.108	11	34.4
cupules	2,725	25.13	5.738	26.474	0.064	0.261	13	40.6
glumes	738	2.48	1.342	7.168	0.005	0.024	10	31.3
cobs	1	0.09	0.002	0.010	a	0.001	1	3.1
embryos	339	1.36	0.589	3.329	0.002	0.013	2	6.3
Total *Zea mays*	26,280	244.28					17	53.1
Wood Charcoal	3,957	42.73	35.160	126.970	1.281	6.681	31	96.9
Bark	39	0.27	0.207	0.351	0.002	0.003	17	53.1
Grass Stems	p	p	p	-	p	-	3	9.4
Cane	8	0.08	0.014	0.079	a	0.001	1	3.1
Pine Cone Fragments	35	0.16	0.365	1.596	0.002	0.006	7	21.9
Phaseolus vulgaris (bean)	9	0.30	-	-	-	-	3	9.4
Seeds	6	0.10	-	-	-	-	13	40.6
Unidentified	508	3.57	-	-	-	-	32	100.0
TOTAL	31,624	305.97	95.398	328.440	2.092	8.636		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fraction; "a" indicates less than 0.001.

TABLE 11

Contents[1] of Summerville II or III Smudge Pit, Lubbub Creek Archaeological Locality.

Identification	Smudge Pit N=1			
	Count	Weight (g)	Mean Count/Liter	Mean Weight/Liter (g)
Nutshells				
Carya sp. (hickory)	3	0.02	0.750	0.005
Quercus sp. (acorn)	p	p	p	p
Total nutshells	3	0.02	0.750	0.005
Corn				
Zea mays kernels	3	0.01	0.750	0.003
cupules	199	1.19	49.750	0.298
glumes	55	0.21	13.750	0.053
Total *Zea mays*	157	1.41		
Wood Charcoal	23	0.11	5.750	0.028
Cane	1	0.01	0.250	0.003
Unidentified	2	0.01	-	-
TOTAL	286	1.56	71.500	0.390

[1]Contents of >2 mm fraction; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in >2 mm fraction.

TABLE 12

Contents[1] of Summerville II or III Hearth, Lubbub Creek Archaeological Locality

Identification	Hearth N=1			
	Count	Weight (g)	Mean Count/Liter	Mean Weight/Liter (g)
Nutshells				
Carya sp. (hickory)	388	6.71	129.330	2.237
Quercus sp. (acorn)	7	0.03	2.333	0.010
Total Nutshells	395	6.74	131.670	2.523
Corn				
Zea mays kernels	15	0.13	5.000	0.043
embryos	2	0.02	0.667	0.007
Total *Zea mays*	17	0.15		
Wood Charcoal	102	0.83	34.000	0.277
Bark	65	1.04	21.667	0.347
Seeds	4	0.03	-	-
Unidentified	72	0.52	-	-
TOTAL	655	9.31	218.330	3.103

[1]Contents of >2 mm fraction.

were nine common bean (Phaseolus vulgaris) cotelydons. These cotyledons along with two cotyledons from Pit 4 in Hectare 500N/-400E, also assigned to the Summerville II or III periods, provided the earliest substantiated evidence of beans at the Lubbub Creek Archaeological Locality.

Pit 26 contained most of the maize remains from Summerville II and III pits. In fact, if this feature were eliminated, there would be almost seven times as many nutshells as maize fragments in Summerville II and III pits.

Hearth 1 (USN 3048) in Hectare 300N/-300E contained two sunflower seeds -- the only evidence of sunflower husbandry during Mature Mississippian times at this locale. The nutshells in this hearth may have been used as fuel. C.E. Smith (1976) suggested that hickory nutshells were the "charcoal fuel" for the prehistoric inhabitants of eastern North America, providing them with a source of fuel which produced a hot, smokeless fire.

Protohistoric Period

Summerville IV Period:

Fifty-six flotation samples from Protohistoric contexts were analyzed. Twenty samples were from pits: Pit 23 in Hectare 300N/-200E, Pits 40, 69, 70, 99, 100, and 108 in Hectare 400N/-300E, Pit 12 in Hectare 400N/-200E, Pit 14 in Hectare 500N/-400E, and Pit 14 in Hectare 500N/-300E. Thirty samples were from two structures: Structures 1 and 2 in Hectare 500N/-300E. One sample was from Hearth 3 in Hectare 400N/-300E, the central hearth of Structure 5. Two were from daub concentrations: one from a daub cap above Urn 2 in Hectare 400N/-200E and another from a daub concentration in Structure 3 in Hectare 500N/-300E. A sample from a charred nut concentration within Structure 2 in Hectare 500N/-300E, one from a burned sand concentration from Structure 3 in Hectare 500N/-300E, and one from a 1 x 1 m excavation unit in Hectare 300N/-300E were also analyzed. Tables 13 and 14 summarize the contents of the Protohistoric pits and structures.

Nutshells outnumbered maize remains in all types of Protohistoric features. Almost 85 percent of the plant food remains by count were nutshells. Acorn shells and nutmeats were also much more abundant than hickory. Sixty-four percent of the nut remains from pits were acorn, and 35 percent were hickory.

One Protohistoric feature, Nut Concentration 1 in Hectare 500N/-300E (USN 6432), furnished measurable acorn nutmeats. Over 2000 fragments of acorn meats were identified in the flotation sample from this feature. Dimensions were measured on fifty of the most complete specimens. There were at least two distinct types of acorns present. Most of the nutmeats were small and almost globular, and they ranged from around 0.5 cm to 0.9 cm in length. Others were larger, ovoid to oblong in shape, and ranged from 1.3 to 1.8 cm long. Nut meats usually shrink by about 15 percent when carbonized, according to the results of experiments conducted by the author. But the percentage of meat to whole acorn varies from species to species. It is difficult to estimate the original sizes of acorns from carbonized nut meats.

The oaks in North America are divided into two groups: the red oaks and the white oaks. Red oak acorns are usually bitter and mature in two seasons,

TABLE 13

Contents[1] of Flotation Samples from Summerville IV Period Pits, Lubbub Creek Archaeological Locality.

Identification	Pits N=20 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	181	4.44	2.850	5.771	0.054	0.111	12	60.0
Juglandaceae	5	0.06	0.042	0.106	0.001	0.001	3	15.0
Quercus sp. (acorn)	320	1.46	5.192	12.303	0.024	0.058	12	60.0
Total Nutshells	506	5.96	8.803	17.393	0.078	0.145	16	80.0
Nutmeats								
Quercus sp. (acorn)	12	0.54	0.183	0.382	0.007	0.019	5	25.0
Juglandaceae	2	0.05	0.017	0.075	a	0.002	1	5.0
Corn								
Zea mays kernels	9	0.11	0.142	0.249	0.002	0.004	7	35.0
cupules	80	0.80	1.075	1.825	0.011	0.019	15	75.0
glumes	5	0.03	0.083	0.213	0.001	0.001	4	20.0
embryos	p	p	p	-	p	-	1	5.0
Total *Zea mays*	94	0.94					16	80.0
Wood Charcoal	1,049	14.30	26.067	68.063	0.446	1.492	20	100.0
Bark	529	5.26	4.725	11.955	0.046	0.110	14	70.0
Grass Stems	6	0.04	0.050	0.188	a	0.001	5	25.0
Pine Cone Fragments	6	0.05	0.058	0.146	0.001	0.002	4	20.0
Seeds	4	0.05	-	-	-	-	8	40.0
Unidentified	133	0.08	-	-	-	-	20	100.0
TOTAL	2,341	28.07	42.258	71.644	0.604	1.488		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fraction; "a" indicates less than 0.001.

TABLE 14

Contents[1] of Flotation Samples from Summerville IV Period Structures, Lubbub Creek Archaeological Locality.

Identification	Structure Cuts N=30 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	26	0.27	0.289	0.408	0.003	0.005	16	53.3
Juglandaceae	3	0.03	0.033	0.183	a	0.002	3	10.0
Quercus sp. (acorn)	84	0.43	0.933	2.219	0.005	0.012	20	66.7
Total Nutshells	113	0.73	1.256	2.233	0.008	0.012	25	83.3
Nutmeats								
Quercus sp. (acorn)	41	0.85	0.456	2.087	0.009	0.040	3	10.0
Corn								
Zea mays kernels	5	0.05	0.056	0.154	0.001	0.002	4	13.3
cupules	35	0.26	0.389	0.778	0.003	0.006	11	36.7
glumes	7	0.05	0.078	0.209	0.001	0.002	4	13.3
Total *Zea mays*	47	0.36					15	50.0
Wood Charcoal	701	7.49	7.789	11.751	0.083	0.131	30	100.0
Bark	83	0.81	9.222	1.901	0.009	0.026	22	73.3
Grass Stems	1	0.01	0.011	0.061	a	0.001	7	23.3
Cane	11	0.06	0.122	0.376	0.001	0.002	3	10.0
Pine Cone Fragments	30	0.23	0.333	1.316	0.003	0.009	6	20.0
Seeds	8	0.24	-	-	-	-	6	20.0
Unidentified	94	0.63	-	-	-	-	26	86.7
TOTAL	1,129	11.41	12.544	14.951	0.127	0.156		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "a" indicates less than 0.001

while white oak acorns are less bitter and mature in one season. The larger nut meats in Nut Concentration 1 were probably from the white oak group; the smaller could have belonged to either group.

General Mississippian

Many features could not be assigned to a particular Summerville period, but could be attributed to the Mississippian occupations. One hundred eleven samples were analyzed from general Mississippian contexts. Fifty of these samples were from pits, thirty-three from smudge pits, six from hearths, eight from structures, two from middens, two from artifact concentrations, three from daub concentrations, two from clay concentrations, one from a corn concentration, one from the ditch, one from an ash concentration, one from a postmold, and one from a piece of burned timber.

These features were located in all hectares excavated and are too numerous to list here. Most of the smudge pits were included in this group, because they rarely contained diagnostic artifacts. Their locations often gave no clue to cultural affiliation, either. Tables 15 through 18 list the contents of the Mississippian pits, smudge pits, hearths, and structures.

Maize was the predominant type of plant food remain in all types of Mississippian features, except structures, the clay concentration, and the ash concentration. Overall, maize accounted for almost 99 percent of the plant food remains from general Mississippian contexts, and nut fragments for only 1 percent.

Most of the smudge pits at the Lubbub Creek Archaeological Locality could only be assigned to the Mississippian period. The most abundant plant remains in the smudge pits were maize cob fragments -- cupules and glumes. Pine cone fragments were next in abundance, and wood charcoal and cane were also frequently identified.

A bean cotyledon was identified from Pit 8 (USN 2481), a smudge pit in Hectare 300N/-200E. Most of the seeds from the Mississippian smudge pits were pine seeds from a single smudge pit, Pit 40 in Hectare 500N/-300E.

Mixed Features

Extensive re-occupation of the Lubbub Creek Archaeological Locality and disturbance from cultivation resulted in a great deal of mixing of archaeological materials on the site. Later features often contained debris from earlier occupations. Although the archaeologist could place some of these features in certain periods, the botanical materials contained therein could not, with confidence, be attributed to those periods. The contents of some of these features were analyzed because they were considered important despite the degree of mixing. Tables 19 and 20 list the contents of pits and structures. Samples were from Structure 5 in Hectare 400N/-300E, Structure 3 in Hectare 500N/-300E, Pit 0 in Hectare 400N/-300E, Pits 6 and 19 in Hectare 400N/-500E, Pit 24 in Hectare 500N/-300E, and a 1 x 1 m excavation unit and Daub Concentration 4 in Hectare 500N/-300E.

Pit 0 (USN 2510) contained the only evidence of squash from the Lubbub Creek Archaeological Locality -- a single fragment of a possible squash seed

TABLE 15

Contents[1] of Flotation Samples from Mississippian Pits, Lubbub Creek Archaeological Locality

Identification	Pits N=50 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp (hickory)	114	1.56	0.867	1.333	0.012	0.018	29	58.0
Juglandaceae	24	0.12	0.160	0.889	0.001	0.004	8	16.0
Quercus sp (acorn)	163	0.77	2.918	19.210	0.013	0.082	24	48.0
Corylus americana (hazelnut)	1	0.01	0.007	0.047	a	a	1	2.0
Total Nutshells	302	2.46	3.952	19.838	0.026	0.093	41	82.0
Acorn Nutmeats	3	0.07	0.020	0.105	a	0.002	2	4.0
Corn								
Zea mays kernels	1,083	17.45	11.452	42.226	0.321	1.749	19	38.0
cupules	2,310	22.65	15.793	52.574	0.162	0.563	27	54.0
glumes	488	2.00	3.267	13.477	0.013	0.056	18	36.0
cobs	1	0.21	0.007	0.047	0.001	0.010	1	2.0
embryos	6	0.04	0.040	0.239	a	0.001	3	6.0
Total *Zea mays*	3,888	42.35				:	32	64.0
Wood Charcoal	6,917	112.51	53.068	200.850	0.887	3.488	50	100.0
Bark	181	0.84	1.213	3.926	0.006	0.019	23	46.0
Grass Stems	28	0.18	0.187	1.069	0.001	0.006	3	6.0
Cane	2	0.14	0.013	0.066	0.001	0.005	2	4.0
Pine Cone Fragments	2,621	15.98	18.793	74.428	0.112	0.449	13	26.0
Seeds	25	0.18	-	-	-	-	13	26.0
Unidentified	352	2.36	-	-	-	-	49	98.0
TOTAL	14,319	177.07	110.210	234.710	1.547	3.971		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in >2 mm fraction; "a" indicates less than 0.001.

TABLE 24

Carbonized Seed Density in Flotation Samples, Lubbub Creek Archaeological Locality.

	Pits		Smudge Pits		Hearths		Structures		Other	
	Mean ct/l	S.D.	Mean ct/l	S.D.	Mean ct/l	S.D	Mean ct/l	S.D	Mean ct/l	S.D
Miller III	0.175	0.396	12.250	3.889	-	-	-	-	-	-
Summerville I	0.095	0.252	5.000	7.071	0.255	0.404	0.151	0.353	0.667	-
Summerville II-III	0.189	0.329	-	-	2.333	-	-	-	1.000	0.943
Summerville IV	0.208	0.436	-	-	-	-	0.189	0.565	2.000	-
Mississippian	0.340	1.114	11.444	62.180	0.028	0.068	0.063	0.124	-	-

Summerville I is daub concentration, Summerville IV is nut concentration. Summerville II-III are midden samples.

habitats either near the site or in the Lubbub Creek Archaeological Locality itself.

We can assume that persimmons, plums, grapes, and maypops were eaten. These fleshy fruits certainly would have been an attractive food resource and would have supplied sugars, vitamins, and minerals to the diet.

Dennell (1976) questioned whether the frequency of seeds or grains on a site can give any indication of their utilization, pointing out that a prevalent weed may have a better chance of being represented than a crop. He suggested an alternative approach to the problem and proposed that a plant resource's importance may be better estimated by looking at the context and composition of the samples in which it occurred. We should therefore "expect the most important plant resources to be most commonly associated with activities such as food preparation, consumption, and storage" (Dennell 1976:234).

Although no seeds were found either in contexts or in quantities sufficient to indicate that they were stored, Dennell's (1976) analytical approach was adopted to see if there was any evidence from the composition of the samples that any of the seeds were utilized. The 97 samples which contained other edible plant parts (corn kernels and embryos and nutmeats) were examined and, of these, 41 also contained seeds. These seeds included all of the following types which were recovered: Chenopodium, Curcurbita, Galium, Helianthus, Iva, Polygonum, Salvia, and Argemone. That is, these seeds were never present unless corn kernels, embryos, or nutmeats were also present. These samples also contained 75 percent of the Passiflora seeds and 79 percent of the Vitis seeds. Forty-four percent of the Phalaris seeds also occurred in these contexts.

Most of the samples that contained edible seeds and other edible plant parts also contained waste products from food preparation (nutshells, corn cupules, and so forth), but the presence of corn kernels and nutmeats may have been the result of accidental spilling of food into a fire, food which may have included some of the seeds present. The samples contained no Amaranthus seeds, and only five (24 percent) of the Poaceae seeds.

Admittedly, the number of seeds is small, and the evidence is far from conclusive that any of the starchy seeds were actually utilized. It is a potentially productive line of research, however, and should yield better data when there is recovery of seeds from contexts indicative of food storage or preparation.

Although it is not possible to state with any confidence that many of the seeds present in the assemblage from the Lubbub Creek Archaeological Locality were actually utilized, these seeds may give some indications of the vegetation in the immediate vicinity and also the degree of disturbance of the area. All seeds present in the archaeological samples were from plants which would have thrived in habitats created by extensive human disturbance. Loblolly pine, persimmon, and plum trees tend to spring up in or along the edges of old fields, and grapes grow along woodland borders. Most of the other seeds present were from weedy annuals which could have grown in agricultural fields along with the cultivated crops and were perhaps cultivated themselves. Conversely, it should be observed that there was no

Creek Archaeological Locality is far from conclusive. Other than the size of the two larger achenes, there is evidence for neither cultivation nor domestication. The sample is extremely small, and the Lubbub Creek Archaeological Locality is not outside the range of wild Iva annua. In fact, we lack evidence that Iva annua was even being used at this locale.

Chenopodium and Phalaris Seeds

Although both Chenopodium and Phalaris have been proposed as native cultigens, evidence for their cultivation is not as convincing as it is for sunflower and sumpweed (Asch and Asch 1976a; Cowan 1978). Cowan (1978) summarized the archaeological evidence for cultivation of maygrass in eastern North America; he concluded that all archaeological grains fell within the size range of modern populations, and evidence along other lines was also lacking. The best evidence for cultivation was the discovery of archaeological maygrass outside the modern geographical range of the plants.

Maygrass seeds recovered from the Lubbub Creek Archaeological Locality were small; in fact, they averaged smaller than the published sizes of modern seeds from the genus. Phalaris is also native to the area, and there is no other reason to suspect that these seeds are from plants which were cultivated.

There is also no evidence that the Chenopodium seeds recovered from the Lubbub Creek samples were from cultivated plants. They ranged from 1.0 to 1.3 mm, with a mean of 1.15 mm. Based on experiments by the author, seed size should be increased by about 22 percent to correct for shrinkage due to carbonization. The original sizes, then, probably ranged from around 1.2 to 1.6 mm, with a mean of 1.4 mm. They are well within the size range of seeds from modern Chenopodium collections.

Seed Utilization

One of the most perplexing problems with which archaeological botanists deal is to determine whether seeds present on an archaeological site are the product of natural dispersal and accidental burning or the result of conscious selection and utilization by a human population. Although many of the seeds from the Lubbub Creek sample were either potentially edible themselves or were from potentially edible fruits, their utilization cannot be inferred merely by their presence. Many of these seeds were also from plants whose vegetative parts could have been used as "greens."

It has been generally accepted that if a particular plant could not grow in habitats on or near a site, the presence of its seeds there could indicate utilization. Asch and Asch (1976b) suspected that Iva annua was utilized at the Koster site because it could not have grown either on or in the close vicinity of the site, and its distribution in the samples was not what would be expected for natural dispersion.

Seed density, as shown in Table 24, was low in most of the Lubbub Creek samples. The highest densities were in smudge pits, in which most of the seeds were pine. From seed density and actual counts of seeds, a case could hardly be made for the contribution of any of these species to subsistence. Moreover, all the plant species represented by these seeds could have grown in

TABLE 23

Iva annua (sumpweed) Seeds from the Lubbub Creek Archaeological Locality.

USN	Hectare	Feature Number	Actual Length (mm)	Estimated Length of Achene (mm)	Actual Width (mm)	Estimated Width of Achene (mm)
Miller III (Late Woodland)						
8968	500N/-200E	Pit 13	2.1[1]	2.3	-	-
2185	400N/-500E	Pit 28, Zone D	2.7	3.7	-	-
Mississippian						
9006	500N/-300E	Pit 35	3.9	5.1	2.4	3.1
Protohistoric						
6411	500N/-300E	Struc. 2, Cut 4	3.5	4.6	-	-

[1]Includes pericarp.

Sumpweed Seeds

Four *Iva annua* (marshelder or sumpweed) seeds were recovered from the Lubbub Creek Archaeological Locality. Two were from Miller III contexts: one from Zone D of Pit 28, a stratified pit in Hectare 400N/-500E, and one from Pit 13, a smudge pit from the pre-mound surface in Hectare 500N/-200E. Another *Iva* seed was from a Protohistoric structure, Structure 2 in Hectare 500N/-300E. The fourth sumpweed seed came from Pit 35 in Hectare 500N/-300E, a Mississippian smudge pit.

Only the seed from Pit 13 had retained its pericarp; it should more correctly be called an achene. Table 23 gives the length and width of each seed or achene, if measurable, and the estimated dimensions of the achenes before carbonization. The corrections for shrinkage are based on results obtained by Yarnell (1972). If the pericarp was lacking, 0.7 mm were added to the length and 0.4 mm to the width, then each dimension was increased by 10 percent. Where the pericarp was present, the dimensions were simply increased by 10 percent. Yarnell's results were used despite the fact that Asch and Asch (1978) demonstrated that correction factors should be smaller for smaller *Iva* seeds. They offered no amended correction factors, however, but demonstrated the need for further investigation of correction factors.

Although nothing definitive may be said on the basis of measurements taken on four seeds, it is interesting that the achenes from later contexts were considerably larger than those from earlier contexts. Such an increase in size through time is often a result of domestication. Asch and Asch (1978) reviewed the evidence for prehistoric domestication of sumpweed in eastern North America and concluded that "the accumulating prehistoric data reinforce the hypothesis of a domestication from *Iva annua*" (Asch and Asch 1978:323). They found that achenes from post-Archaic archaeological contexts were larger than those from modern collections and that there seemed to be a general increase in size through time in the prehistoric samples.

While Asch and Asch used modern collections from the lower Illinois and the Mississippi River valleys and archaeological data from the lower Illinois valley, Yarnell (1978) reported dimensions of archaeological sumpweed seeds from several other states. Comparing the seeds from the Lubbub Creek Archaeological Locality with those reported by the above authors, we see that the dimensions of the earlier, Miller III achenes are well within the range of modern wild achenes. In archaeological contexts, achenes as large as 3.7 mm in length are not found earlier than Middle Woodland in the lower Illinois valley, but are found in late Archaic to early Woodland contexts in Kentucky, Tennessee, and Missouri.

Two other seeds from Lubbub, from a Protohistoric and a general Mississippian context, are comparable in size to those reported from Late Archaic to early Woodland and later archaeological sites by Yarnell (1978) and to those from Middle Woodland and later sites reported by Asch and Asch (1978). Achenes this large were not reported from earlier Archaic contexts. Modern wild achenes as large as 4.6 mm in length were harvested from the Apple Creek location in Illinois by Asch and Asch (1978:323), but they harvested no wild achenes as long as 5.1 mm.

The evidence for cultivation or domestication of *Iva annua* at the Lubbub

TABLE 22

Sunflower Seeds (*Helianthus annuus*) from the Lubbub Creek Archaeological Locality.

USN	Hectare	Feature Number	Actual Length (mm)	Estimated Length of Achene (mm)	Actual Width (mm)	Estimated Width of Achene (mm)
3048	300N/-300E	Hearth 1	5.1	6.6	2.7	3.9
			5.9	7.7	3.3[1]	3.9
3637	500N/-400E	Hearth 1, Zone A	6.4	8.3	2.9	4.2
			7.0	9.1	2.6	3.8
			5.7	7.4	2.6	3.8
3878	500N/-400E	Hearth 1A, Zone D	7.7	10.0	2.5	3.6

[1]Includes pericarp.

sunflowers in the eastern United States and concluded that there was "no evidence for aboriginal sunflower husbandry from Alabama, Georgia, Florida, or South Carolina." Scarry (1980) found sunflower seeds in Mississippian contexts at Moundville. Swanton (1946:288) listed one ethnographic reference by Romans which indicated that, at least by the late eighteenth century, the Choctaw cultivated sunflowers; the seeds were made into a flour and, mixed with corn flour, made into a bread.

The fruit of the sunflower is an achene, consisting of a single seed enclosed in a pericarp. Only one of the seeds from the Lubbub samples retained part of its pericarp. Because all seeds were carbonized, they were smaller than their original size. Heiser (1978:48) charred achenes from seven different varieties of sunflowers and found that "on the average the charred achenes were 90% as long and 85% as wide as uncharred ones." The author carbonized ten modern cultivated sunflower achenes and had similar results; the carbonized achenes were 90 percent as long and 82 percent as wide as they were before carbonization.

Using results of his own experiments, Yarnell (1978) suggested that carbonized <u>seed</u> length should be increased by 30 percent and <u>seed</u> width by 45 percent or more to obtain estimates of original <u>achene</u> size. The author duplicated Yarnell's results, using modern cultivated sunflower achenes.

Yarnell's correction factors were used to approximate the sizes of the original achenes from the Lubbub Creek seeds. For the seed which retained part of its pericarp, Heiser's (1978) results were used to estimate the original width of the achene. All measurements are reported in Table 22.

The approximated lengths of the original achenes ranged from 6.6 to 10.0 mm, and the approximated widths from 3.6 to 4.2 mm. The mean converted length was 8.2 mm, and mean width was 3.9 mm. The length x width products ranged from 25.7 to 36.0 with a mean of 31.6. These measures place them among the smaller sunflower seeds recovered from archaeological sites and among the very smallest recovered from Mississippian sites (Heiser 1978; Yarnell 1978). Although achenes this small have been recovered from Mississippian sites, the measurements of the Lubbub Creek sample are far below the means as computed by Yarnell. The mean converted length x width products for sunflower achenes from Mississippian sites reported by Yarnell ranged from 41 to 82, but the mean products for Middle to early Late Woodland samples ranged from 25 to 36, exactly the same range computed for the Lubbub Creek sunflower achenes. When comparing the estimated dimensions of the Lubbub Creek sunflower achenes to those reported by Yarnell, it should be noted that when he converted carbonized archaeological achene widths to approximate original widths, Yarnell used earlier unpublished results obtained by Heiser and increased widths by 27 percent. Thus some of his measurements may be slightly larger than they should be according to Heiser (1978). This would also make his length x width products slightly larger.

The sample of sunflower seeds from the Lubbub Creek Archaeological Locality is indeed small and may not be representative of the population from which it came. It may be stated, however, that the sizes of the seeds indicated they were from domesticated plants. Also, their occurrence here is well outside the range of wild sunflowers, which are southwestern. This supports their status as seeds from cultivated plants.

TABLE 21

Seeds[1] from the Lubbub Creek Archaeological Locality.

Species	Miller III	Summer-ville I	Summer-ville II-III	Summer-ville IV	Missis-sippian	Mixed Contexts	TOTAL
<u>Amaranthus</u> sp.							
Pigweed	-	-	1	-	-	-	[illegible]
<u>Argemone</u> sp.							
Prickly Poppy	1	-	-	-	-	-	[illegible]
<u>Chenopodium</u> sp.							
Lamb's Quarters	12	-	1	-	2	-	15
<u>Croton</u> sp.							
Doveweed	-	-	-	-	2855	-	2855
<u>Cucurbita</u> sp.							
Squash	-	-	-	-	-	1	1
Cucurbitaceae							
Gourd Family	-	-	-	1	1	-	2
Cyperaceae							
Sedge Family	1	-	2	-	1	-	4
<u>Diospyros virginiana</u>							
Persimmon	1	9	13	24	10	6	63
Fabaceae							
Bean Family	-	1	1	1	-	-	3
<u>Galium aparine</u>							
Bedstraw	-	-	-	4	-	-	4
<u>Helianthus annuus</u>							
Sunflower	-	9	2	-	-	-	11
<u>Iva annua</u>							
Sumpweed	2	-	-	1	1	-	4
<u>Passiflora incarnata</u>							
Maypop	-	1	6	-	1	-	8
<u>Phalaris caroliniana</u>							
Maygrass	2	1	11	1	2	1	18
<u>Pinus</u> sp.							
Pine	157	-	-	1	2203	-	2361
Poaceae							
Grass Family	10	6	2	1	2	-	21
<u>Polygonum</u> sp.							
Knotweed	1	-	-	-	-	-	1
<u>Prunus americana</u>							
Plum	-	-	4	-	12	4	20
<u>Salvia</u> sp.							
Sage	-	-	1	-	-	-	[illegible]
<u>Vitis</u> sp.							
Grape	2	-	4	5	2	1	14
Seed Fragments	9	18	6	15	20	4	72
Unidentified Seeds	6	11	6	7	15	1	46
TOTAL	204	56	60	61	5127	18	5526

[1]Includes seeds recovered in waterscreen and in flotation samples.

was recovered from this pit.

SEEDS

Five thousand four hundred twenty-seven seeds were pulled from the flotation samples. Of these, 2,855 were doveweed (Croton sp.) seeds from an artifact concentration which consisted of several sherds of a Mississippi Plain var. Warrior vessel. The seeds were directly beneath the broken sherds. Although obviously old, the seeds were not carbonized, and it is unlikely that, even protected by the overlying sherds, they had been in the ground for several hundred years. They were probably a rodent's cache and are mentioned here only because there is a slight possibility that they were indeed associated with the sherds. With the exception of the Croton seeds, all uncarbonized seeds were assumed to be modern contamination and were not analyzed.

The most common carbonized seed on the site was pine (Pinus sp.). Two thousand three hundred fifty-six pine seeds were identified in flotation samples, most of them in samples from smudge pits. They were always associated with fragments of pine cones which were often used for fuel.

Only two hundred sixteen other seeds or seed fragments were identified in the flotation samples: one fragment of a possible squash seed (Cucurbita pepo), eleven sunflower (Helianthus annuus), one pigweed (Amaranthus sp.), fifteen goosefoot (Chenopodium sp.), five persimmon (Diospyros virginiana), three bean family (Fabaceae), four bedstraw (Galium sp.), four sumpweed (Iva annua), eight maypop (Passiflora incarnata), eighteen maygrass (Phalaris caroliniana), twenty-one grass family (Poaceae), one knotweed (Polygonum sp.), fourteen grape (Vitis sp.), two gourd family (Cucurbitaceae), four sedge family (Cyperaceae), one sage (Salvia sp.), and one prickly poppy (Argemone sp.). Sixty-five seeds were too fragmentary for identification, and thirty-seven seeds could not be identified.

In addition to seeds recovered in the flotation samples, 99 seeds were recovered in the quarter-inch waterscreened samples. As would be expected, these were the larger, more durable seeds: fifty-eight persimmon seeds, twenty plum seeds (Prunus americana), five pine seeds, seven large spherical seeds which could not be identified, and nine other unidentified seeds or fragments. Seed data for both waterscreened and flotation samples are reported in Table 21. Some of these seeds merit special discussion because there is evidence that they were cultivated or domesticated by prehistoric populations in the Eastern United States.

Sunflower Seeds

Six sunflower (Helianthus annuus) seeds and five seed fragments were recovered during excavations in the Lubbub Creek Archaeological Locality. All were from hearths: two from Hearth 1 in Hectare 300N/-300E, dated to the Summerville II or III periods, and nine from Hearth 1 in the center of Structure 1 in Hectare 500N/-400E, assigned to the Summerville I period.

The recovery of these seeds is significant because there is little evidence of sunflower in archaeological context in the lower Southeast. Yarnell (1978:291) summarized the evidence for prehistoric cultivation of

TABLE 20

Contents[1] of Flotation Samples from Mixed Structures, Lubbub Creek Archaeological Locality.

Identification	Structures N=20 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weigh/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	16	0.16	0.267	0.558	0.003	0.005	7	35.0
Juglandaceae	p	p	p	-	p	-	1	5.0
Quercus sp. (acorn)	2	0.02	0.033	0.103	a	0.001	6	30.0
Total Nutshells	18	0.18	0.300	0.620	0.003	0.006	11	55.0
Corn								
Zea mays kernels	5	0.06	0.083	0.239	0.001	0.003	3	15.0
cupules	37	0.37	0.617	1.579	0.006	0.015	6	30.0
glumes	4	0.04	0.067	0.137	0.001	0.001	4	20.0
stalks	p	p	p	-	p	-	1	5.0
Total *Zea mays*	46	0.47					9	45.0
Wood Charcoal	736	9.63	12.267	21.060	0.161	0.292	20	100.0
Bark	167	1.31	2.783	4.009	0.022	0.036	19	95.0
Grass Stems	1	0.01	0.017	0.075	a	0.001	1	5.0
Cane	1	0.07	0.017	0.075	0.001	0.005	1	5.0
Seeds	p	p	-	-	-	-	3	15.0
Unidentified	38	0.38	-	-	-	-	19	95.0
TOTAL	1,007	12.05	16.783	22.490	0.201	0.312		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fraction; "a" indicates less than 0.001.

TABLE 19

Contents of Flotation Samples from Mixed Pits, Lubbub Creek Archaeological Locality.

Identification	Pits N=8 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
[illegible] (hickory)	135	2.23	3.042	4.543	0.049	0.087	6	75.0
[illegible]ed hickory	1	0.01	0.021	0.059	a	a	1	12.5
[illegible]andaceae	p	p	p	-	p	-	1	12.5
[illegible] sp. (acorn)	12	0.06	0.250	0.642	0.001	0.003	4	50.0
[illegible] nigra (walnut)	1	0.02	0.021	0.059	a	0.001	1	12.5
[illegible]	6	0.11	0.125	0.248	0.002	0.005	2	25.0
[illegible] Nutshells	155	2.43	3.458	5.512	0.053	0.096	6	75.0
[illegible]								
Zea mays kernels	11	0.10	0.229	0.417	0.002	0.004	3	37.5
cupules	9	0.09	0.271	0.462	0.003	0.004	4	50.0
glumes	2	0.02	0.042	0.077	a	0.001	2	25.0
Total *Zea mays*	22	0.21					4	50.0
Wood Charcoal	814	9.77	28.604	58.565	0.357	0.789	8	100.0
Bark	7	0.06	0.146	0.301	0.001	0.002	3	37.5
Pine Cone Fragments	1	0.01	0.042	0.118	a	0.001	1	12.5
Seeds	2	0.01	-	-	-	-	3	37.5
Unidentified	35	0.29	-	-	-	-	8	100.0
TOTAL	1,036	12.78	33.604	57.808	0.424	0.777		

Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in the smaller (1-2 mm or <1 mm) fractions, but not in the >2 mm fraction; "a" indicates less than 0.001

TABLE 18

Contents[1] of Flotation Samples from Mississippian Structures, Lubbub Creek Archaeological Locality

Identification	Structure Cuts N=8 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	49	0.51	1.021	0.774	0.011	0.009	7	87.5
Juglandaceae	p	p	p	-	p	-	2	25.0
Quercus sp. (acorn)	p	p	p	-	p	-	1	12.5
Total Nutshells	49	0.51	1.021	0.774	0.011	0.009	7	87.5
Corn								
Zea mays kernels	2	0.04	0.042	0.077	0.001	0.002	2	25.0
Wood Charcoal	364	3.15	7.583	8.993	0.066	0.075	8	100.0
Bark	78	1.00	1.625	3.941	0.021	0.054	5	62.5
Seeds	3	0.03	-	-	-	-	2	25.0
Unidentified	36	0.30	-	-	-	-	8	100.0
TOTAL	532	5.03	11.083	10.569	0.105	0.098		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in >2 mm fraction.

TABLE 17

Contents[1] of Flotation Samples from Mississippian Hearths, Lubbub Creek Archaeological Locality.

Identification	Hearths N=6 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D.	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	1	0.02	0.056	0.136	0.001	0.003	1	16.7
Juglandaceae	p	p	p	-	p	-	2	33.3
Quercus sp. (acorn)	p	p	p	-	p	-	2	33.3
Total Nutshells	1	0.02	0.056	0.136	0.001	0.003	4	66.7
Corn								
Zea mays cupules	3	0.03	0.167	0.279	0.002	0.003	4	66.7
Wood Charcoal	23	0.37	0.491	0.448	0.005	0.007	6	100.0
Bark	2	0.02	0.111	0.172	0.001	0.002	5	83.3
Seeds	p	p	-	-	-	-	1	16.7
Unidentified	1	0.01	-	-	-	-	5	83.3
TOTAL	30	0.45	0.833	0.782	0.009	0.008		

[1]Contents of >2 mm fraction, except number of occurrence and percent occurrence, which are for all fractions; "p" indicates present in smaller (1-2 mm or <1 mm) fractions, but not in >2 mm fraction.

TABLE 16

Contents[1] of Flotation Samples from Mississippian Smudge Pits, Lubbub Creek Archaeological Locality

Identification	Smudge Pits N=33 Samples							
	Count	Weight (g)	Mean Count/Liter	S.D.	Mean Weight/Liter (g)	S.D	Number of Occurrences	Percent Occurrence
Nutshells								
Carya sp. (hickory)	66	0.99	0.520	1.192	0.010	0.023	13	39.4
Juglandaceae	2	0.04	0.020	0.116	a	0.002	3	9.1
Quercus sp. (acorn)	128	0.35	1.178	5.501	0.003	0.010	12	36.4
Corylus americana (hazelnut)	1	0.01	0.010	0.058	a	0.001	1	3.0
Total Nutshells	197	1.39	1.728	5.530	0.013	0.025	21	63.6
Corn								
Zea mays kernels	4,725	73.43	28.876	153.200	0.449	2.482	20	60.6
cupules	32,031	338.62	313.450	432.510	3.596	6.142	28	84.9
glumes	9,616	32.80	81.359	123.750	0.278	0.446	21	72.7
cobs	14	4.12	0.082	0.240	0.022	0.083	5	15.2
embryos	54	0.15	0.327	1.880	0.001	0.005	3	9.1
stalks	3	0.16	0.071	0.351	0.003	0.014	2	6.1
Total *Zea mays*	46,443	449.28					29	87.9
Wood Charcoal	5,059	96.48	47.549	81.714	0.860	2.374	31	93.9
Bark	480	7.33	7.072	24.816	0.121	0.468	13	39.4
Cane	1,450	32.68	24.471	88.219	0.360	1.139	9	27.3
Pine Cone Fragments	21,615	196.79	141.100	545.420	1.224	4.997	10	30.3
Phaseolus vulgaris (bean)	1	0.04	-	-	-	-	1	3.0
Seeds	1,585	11.10	-	-	-	-	11	33.3
Unidentified	868	4.16	-	-	-	-	31	93.9
TOTAL	77,698	799.25	664.130	993.450	7.031	10.613		

[1]Contents of >2 mm fraction, except number of occurrences and percent occurrence, which are for all fractions; "a" indicates less than 0.001.

significant increase either in numbers or in the diversity of these weed seeds from Miller III through Mississippian times.

BEANS

Ten bean (Phaseolus vulgaris) cotyledons and a whole bean were recovered from the Lubbub Creek Archaeological Locality. The whole bean was from a large Summerville III pit, Pit 4 in Hectare 500N/-400E. A fragment of a bean cotyledon was also identified from Cut 4 of this pit. The remaining cotyledons were found in three features located in Hectare 300N/-200E: seven from Pit 26, attributed to the Summerville III occupation, one from Pit 5, a Mississippian pit, and one from Pit 8, a Mississippian smudge pit. Actual measurements of the bean fragments, uncorrected for shrinkage due to carbonization, are reported in Table 25.

Although it has been proposed that Mississippian peoples subsisted mainly on corn, beans, and squash, large numbers of beans are seldom encountered on Mississippian sites. Dunn (1979) found no beans at Cemochechobee, and Chmurney (1973) reported that only a single bean had been recovered from Cahokia. The first archaeological evidence for common beans in Alabama was from site 1Pi12, a site within the Lubbub Creek Archaeological Locality. Twenty-seven beans were identified (Smith, C.E. 1975:279) from a Mississippian postmold. The paucity of beans on Mississippian sites may simply be due to the fact that chances for carbonization may have been fewer for beans than for other types of plant food remains.

TEMPORAL VARIATION IN THE PLANT REMAINS

The difficulties in assessing the importance of plant foods from samples of archaeological plant remains have been discussed repeatedly in contemporary paleoethnobotanical literature. As has been observed, a multitude of factors affect the quality, quantity, and composition of botanical residue (Munson et al 1971; Cutler and Blake 1973; Ford 1979; Dennell 1976; Wing and Brown 1979). These factors include the nature of the plant part, the methods of gathering and processing used by the prehistoric population, the rate of utilization, post-depositional activities on a site, and the recovery, laboratory processing, and identification procedures used by the archaeologist. Put simply, it is apparent that the proportions in which plant remains are present in an archaeological deposit cannot be assumed to reflect directly their actual contributions to subsistence.

In spite of the numerous biases which affect archaeological samples, their composition nonetheless may reflect general trends in plant use through time. Ubiquity of an item is often accepted as evidence that it was utilized. Quantitative comparisons have been made between assemblages on the assumption that if certain plant foods are represented much more frequently in one assemblage than another, this measure may indicate that their use increased. By considering the ubiquity of items in the Lubbub assemblages, their densities, and the proportion each forms of the food plant remains, I will try to assess the importance of the various plant foods to the subsistence of the prehistoric occupants of the Lubbub Creek Archaeological Locality.

Plant remains were identified from proveniences attributed to a cultural sequence that ranged from the Gulf Formational to the Protohistoric period.

TABLE 25

Common Beans (Phaseolus vulgaris) from the Lubbub Creek Archaeological Locality.

USN	Hectare	Provenience	Length (mm)	Width (mm)
2481	300N/-200E	Pit 8	-	5.1
2486	300N/-200E	Pit 5	9.7	5.6
2896	300N/-200E	Pit 26	11.3	6.2
			11.0	6.4
			-	5.9
			-	6.4
3599	500N/-400E	Pit 4	10.6	5.7

The samples from the earlier, Gulf Formational and Middle Woodland, occupations were extremely small and cannot be readily compared to the samples attributed to later occupations.

The Late Woodland, Mississippian, and Protohistoric occupants of the Lubbub Creek Archaeological Locality used essentially the same types of food plants, but there were apparently substantial changes in the proportions in which they were utilized. Unless noted otherwise, the following interpretations are based solely on data from flotation samples.

It appeared that the fall nut crops were an important dietary resource at all times the Lubbub Creek Archaeological Locality was occupied. Nut shell or nut meat fragments occurred in more features (Figure 1) and in more discrete samples than maize fragments in all assemblages. Although nut fragments occurred in more features, however, they only formed large proportions of the plant food remains from Woodland and Protohistoric contexts. Table 26 summarizes the plant food remains by count from all proveniences. Nuts accounted for over 99 percent of the plant food remains, by count, from Miller III refuse-filled pits. They were much less frequent in Summerville I, II, and III pits, comprising seven percent of the food plant remains from Summerville I pits and three percent of those from Summerville II and III pits. About seven percent of the food plant remains from general Mississippian pits were nut fragments. In the Protohistoric Summerville IV samples, nuts comprised 85 percent of the plant food remains.

Density of nut fragments, computed as mean count per liter of soil floated, was also highest in the Miller III pits, at 16 fragments per liter, lowest in the Summerville I pits, at 0.6 fragments per liter, then increased to 10.2 fragments per liter in the Summerville II and III pits, and decreased slightly in the Summerville IV pits, to 8.1 fragments per liter. General Mississippian pits contained around four nut fragments per liter.

The density of maize fragments in the Miller III pits was less than 0.1 fragments per liter. Their density increased to 7.6 fragments per liter in Summerville I pits, to 47 fragments per liter in Summerville II and III pits, and then decreased to 1.3 fragments per liter in Summerville IV pits. There were over 30 fragments of maize per liter in general Mississippian pits.

Maize also formed an extremely small proportion of the food plant remains in the Miller III pits -- less than one percent of the total count. In Summerville I pits, maize fragments were much more frequent, accounting for 93 percent of the food plant remains by count. Maize fragments comprised 97 percent of total count of food plant remains from Summerville II and III pits, 93 percent of those from general Mississippian pits, and only 15 percent of those from Summerville IV pits.

It has been mentioned that the large amount of maize remains from Summerville II and III contexts was due mainly to a single feature which contained over 26,000 maize cob or kernel fragments. It was noted that, if this feature was not considered, there would be almost seven times as many nutshell fragments as maize fragments from the Summerville II and III pits. Although the actual contributions of the nut crops and maize to the diet cannot be estimated, the dominance of maize fragments in general Mississippian pits suggests that throughout the Mississippian period, maize was extremely

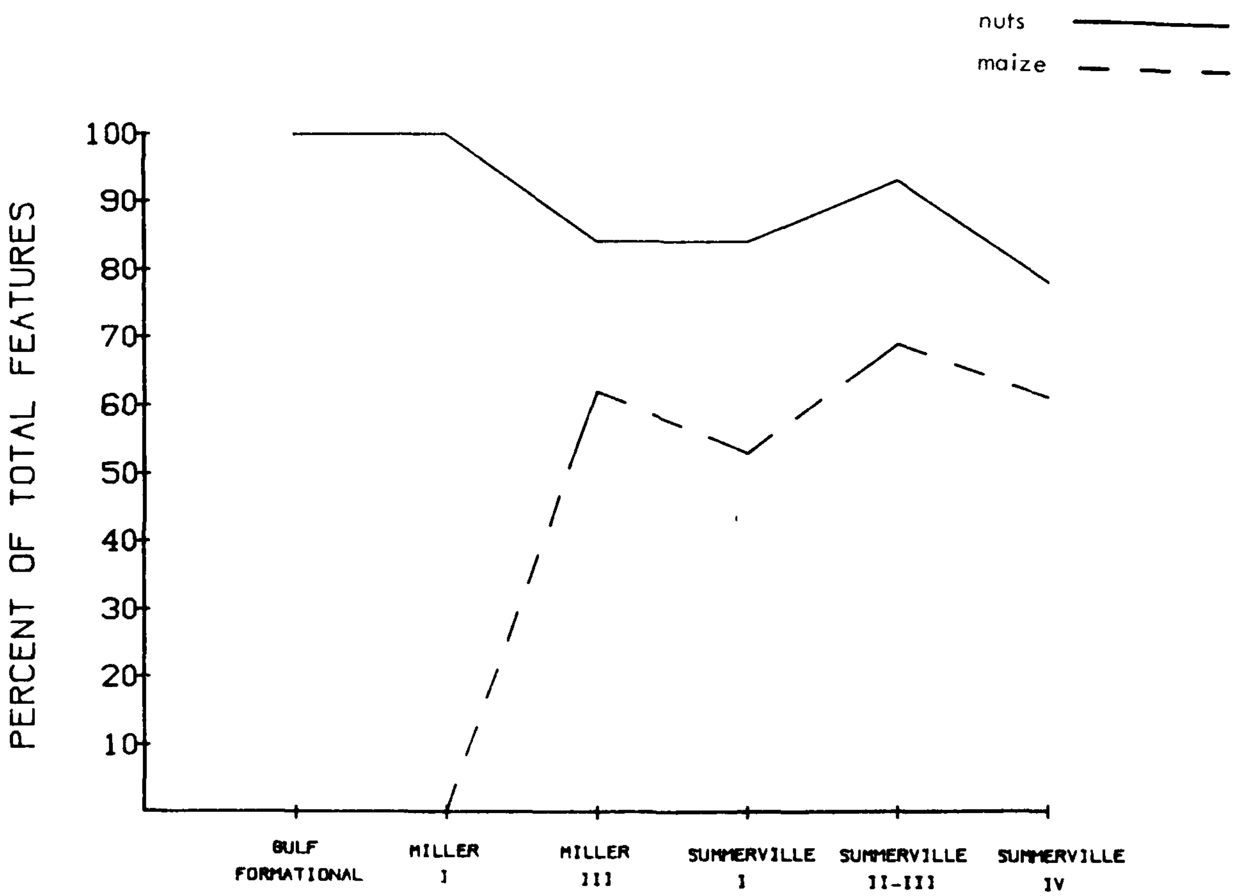

Figure 1. Percent Occurrence of Maize and Nuts.

TABLE 26

Summary of Plant Food Remains by Count from the Lubbub Creek Archaeological Locality[1]

Provenience	Total Count	Hickory	Acorn	Walnut	Pecan	Hazel-nut	Beech	Jugland-aceae	Maize	Beans
	Percent of Total Count									
Gulf Formational Period										
Refuse pits	-	-	-	-	-	-	-	p	-	-
Artifact concentration	4	100.0	-	-	-	-	-	p	-	-
Woodland Period										
Miller I period										
Refuse pit	30	86.7	13.3	-	-	-	-	-	-	-
Miller III period										
Refuse pits	2,198	47.6	51.7	0.05	0.3	-	-	p	0.4	-
Smudge pits	13,092	-	-	-	-	-	-	-	100.0	-
Mississippian Period										
Summerville I period										
Refuse pits	172	4.7	2.3	-	-	-	-	-	93.0	-
Smudge pits	3,336	1.2	p	-	-	-	-	-	98.8	-
Hearths	76	56.6	6.6	-	-	-	-	-	36.8	-
Structures	15	66.7	p	-	-	-	-	6.7	26.7	-
Midden	2	100.0	p	-	-	-	-	-	-	-
Daub concentration	7	71.4	p	-	-	-	-	-	28.6	-
Burned sand concentration	-	-	-	-	-	-	-	p	-	-
Summerville II-III periods										
Refuse pits	27,071	2.7	0.2	-	-	-	p	0.03	97.1	0.03
Smudge pit	260	1.2	p	-	-	-	-	-	98.8	-
Hearth	412	94.2	1.7	-	-	-	-	-	4.1	-
Structure cut	2	100.0	-	-	-	-	-	-	-	-
Middens	24	37.5	12.5	-	-	-	-	-	50.0	-
Protohistoric Period										
Summerville IV period										
Refuse pits	614	29.5	54.1	-	-	-	-	1.1	15.3	-
Structure cuts	201	12.9	62.2	-	-	-	-	1.5	23.4	-
Nut concentration	3,721	1.5	98.4	-	-	-	-	-	0.1	-
Midden	2	50.0	-	-	-	-	-	-	50.0	-
Daub concentration	-	p	-	-	-	-	-	-	-	-
Hearth	-	-	p	-	-	-	-	-	-	-
General Mississippian										
Refuse pits	4,193	2.7	4.0	-	-	0.02	-	0.6	92.7	-
Smudge pits	46,641	0.1	0.3	-	-	0.002	-	0.004	99.6	0.002
Hearths	4	25.0	p	-	-	-	-	p	75.0	-
Structure cuts	51	96.1	p	-	-	-	-	p	3.9	-
Midden	6	16.7	-	-	-	-	-	-	83.3	-
Clay concentration	52	100.0	-	-	-	-	-	p	-	-
Artifact concentration	1	-	-	-	-	-	-	-	100.0	-
Daub concentration	4	25.0	p	-	-	-	-	-	75.0	-
Ash concentration	3	100.0	p	-	-	-	-	-	-	-
Corn concentration	62	-	6.5	-	-	-	-	-	93.5	-

[1]Percentages are for plant food remains from >2 mm fraction from flotation samples; "p" indicates present in the 1-2 mm or <1 mm fractions, but not in the >2 mm.

important in the diet.

Although the densities of both maize and nut fragments increased in the Summerville II and III pits, this may be a result of the larger population occupying the site during this time. Density of all botanical remains, including wood charcoal, was higher in pits from the Summerville II and III periods than in pits from earlier and later periods.

In addition to the variations between assemblages in the proportions of wild and domesticated plant remains present, there were also differences in the relative proportions of the types of nuts represented. Table 27 lists the data for all nut remains from the Lubbub Creek Archaeological Locality. Hickory was the only type of nut represented in samples from the Gulf Formational period. Hickory was dominant in the Miller I sample, but acorn also occurred. In the Late Woodland Miller III samples, additional types of nuts -- walnut and pecan -- were represented. However, in the Miller III samples, hickory and acorn fragments were still the most frequent type of nut remains; they were almost equally represented by count, while pecan and walnut occurred in smaller frequencies. Walnut shells constituted seven percent of the total weight of nutshell fragments from the waterscreened samples and were present in 38 percent of the Miller III features. The greater diversity in the Miller III samples than in earlier samples may be a result of the larger number of samples available for analysis.

Only hickory and acorn were represented in the Summerville I samples. In these samples, hickory was the dominant type, constituting over 91 percent of the total nut remains identified, and acorn shells comprised eight percent of the nut remains by count. The proportions were similar for the Summerville II and III samples; hickory nut remains accounted for over 95 percent of the total nut remains and acorn remains for almost five percent. Walnut occurred only in the Summerville II and III samples from the waterscreen, but it was less than one percent of the total weight of nutshells recovered in this manner. There was a single occurrence of beech nut shell in a small fraction of a flotation sample.

The proportions of nut types represented in the Protohistoric samples differed significantly from the Mature Mississippian samples; acorn shell and nut meat fragments accounted for over 93 percent of the total nut remains, by both count and weight. Although the largest amount of acorn remains were from a single nut concentration, 64 percent of the nut remains from pits and 81 percent of those from structures were acorn. Figure 2 shows the proportions the various types of nut remains formed of the total nut remains from flotation samples.

Acorn shells tend to break into smaller pieces than hickory and walnut shells and, consequently, a sample recovered from a quarter-inch waterscreen usually is skewed in favor of nuts represented by the larger pieces. However, acorn remains far outweighed hickory in the waterscreened sample from Protohistoric contexts, comprising 80 percent by weight of the nut remains recovered.

Figure 3 shows the ubiquity of the various types of nuts, expressed as the percent of features in which each type was represented. Despite the variations in abundance of the various nut types between assemblages, hickory

TABLE 27

Nuts by Cultural Provenience

	Total Nuts		Hickory % of Total Nuts		Acorn % of Total Nuts		Walnut % of Total Nuts	
	Ct.	Wt.(g)	Ct.	Wt.(g)	Ct.	Wt.(g)	Ct.	Wt.(g)
Gulf Formational Period								
1/4" waterscreen		0.10		100.0				
flotation	4	0.05	100.0	100.0				
Miller I Period								
1/4" waterscreen		4.86		99.2		0.8		
flotation	30	0.42	86.7	92.9	13.3	7.1		
Miller III Period								
1/4" waterscreen		58.71		89.8		3.2		7.0
flotation	2,190	26.40	47.8	75.8	51.9	23.1	0.05	0.7
Summerville I Period								
1/4" waterscreen		2.40		95.8		4.2		
flotation	117	1.33	91.5	91.0	7.7	6.8		
Summerville II-III Periods								
1/4" waterscreen		120.94		99.6		0.1		0.2
flotation	1,194	21.38	94.6	97.2	4.7	2.2		
Summerville IV Period								
1/4" waterscreen		47.5		20.0		80.0		
flotation	4,391	103.98	6.0	5.1	93.8	94.8		
Mississippian Period								
1/4" waterscreen		13.4		65.7		29.9		4.5
flotation	614	5.23	46.9	72.7	48.5	23.9		

TABLE 27

(Continued)

	Hazelnut % of Total Nuts		Pecan % of Total Nuts		Juglandaceae % of Total Nuts	
	Ct.	Wt.(g)	Ct.	Wt.(g)	Ct.	Wt.(g)
Gulf Formational Period						
1/4" waterscreen						
flotation						
Miller I Period						
1/4" waterscreen						
flotation						
Miller III Period						
1/4" waterscreen						
flotation			0.3	0.4		
Summerville I Period						
1/4" waterscreen						
flotation					0.9	2.3
Summerville II-III Periods						
1/4" waterscreen						
flotation					0.7	0.5
Summerville IV Period						
1/4" waterscreen						
flotation					0.2	0.1
Mississippian Period						
1/4" waterscreen						
flotation	0.3	0.4			4.2	3.1

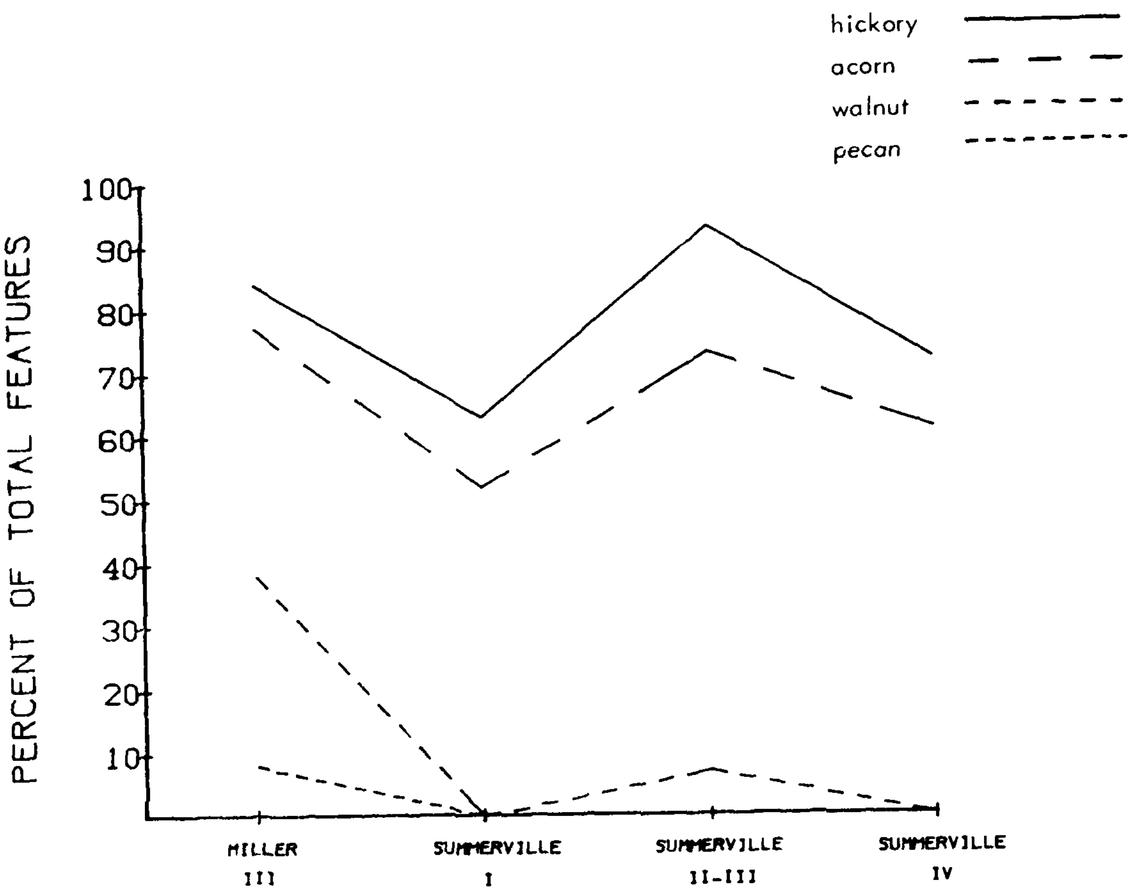

Figure 2. Nut proportions by cultural period from flotation samples.

remains always occurred in more features than the other types, and acorn in slightly fewer features. Walnut shells were fairly common in Miller III pits, but were infrequent in later features. Pecan shell was present only in a Miller III feature.

Acorn is probably under-represented in the tabulations for all periods because the totals reported are for pieces which were larger then 2 mm. Acorn, more often than any other type of plant remain, was frequently identified in the smaller fractions when it did not occur in the large. If, as Yarnell (1974:119) suggests, 1 gram of acorn shell represents as much food as 20 grams of hickory nutshell, then the acorn shells in Miller III contexts from the Lubbub Creek Archaeological Locality represent six times as much food as the hickory nut shells; and the acorn shell from Summerville I contexts represent one and one-half times as much food as the hickory nutshells. Hickory nutshells from Summerville II and III contexts would still represent more food than acorn shells from these contexts -- about twice as much. In the Protohistoric samples, the acorn shells present would represent 44 times as much food as the hickory nutshells.

The actual intensity of utilization of acorns as compared to hickory nuts cannot be determined for any period; but the general trends in the data seem to indicate that hickory nuts, acorns, and walnuts were all important food resources during the Late Woodland period. Use of acorns apparently declined during the Mississippian period, and then increased substantially in the Protohistoric. Pecans, hazelnuts, and beech nuts never appeared to be of much importance as food resources.

Data from earlier excavations (Caddell 1979) of Site 1Pi33 can be used for comparison with the data here. In one such controlled comparison, the contents of a large Late Miller III pit were found to be very similar to the contents of Miller III pits reported here. Nuts (in flotation samples) formed 98 percent of the plant food remains by weight, and maize fragments formed two percent. Weights of acorn and hickory nutshells were about equal. Plant food remains from a late Mississippian structure at the site were composed of 28 percent maize fragments, 63 percent hickory nutshells, and 9 percent acorn shells.

In general, then, use of maize apparently increased substantially from Late Woodland to Mississippian times at this locality. Maize was probably the main carbohydrate source throughout the Mississippian period, but its use seemed to decrease somewhat during the Protohistoric period. At the same time, there appeared to be changes in emphasis on different types of nuts. To understand why these changes may have occurred, let us look at the nutritional significance of each type of nut (Table 28).

The dietary significance of nuts was mainly as a source of carbohydrates, but nuts contain high amounts of fats as well. They are consequently high in calories or energy. Black walnuts and hickory nuts contain about six and four times respectively as much fat as that contained by acorns. Nuts are also important sources of protein, although they are not a good substitute for animal protein because of their high fat content (Woodroof 1979). Acorns have a higher carbohydrate content, but a lower protein content than hickory nuts and black walnuts.

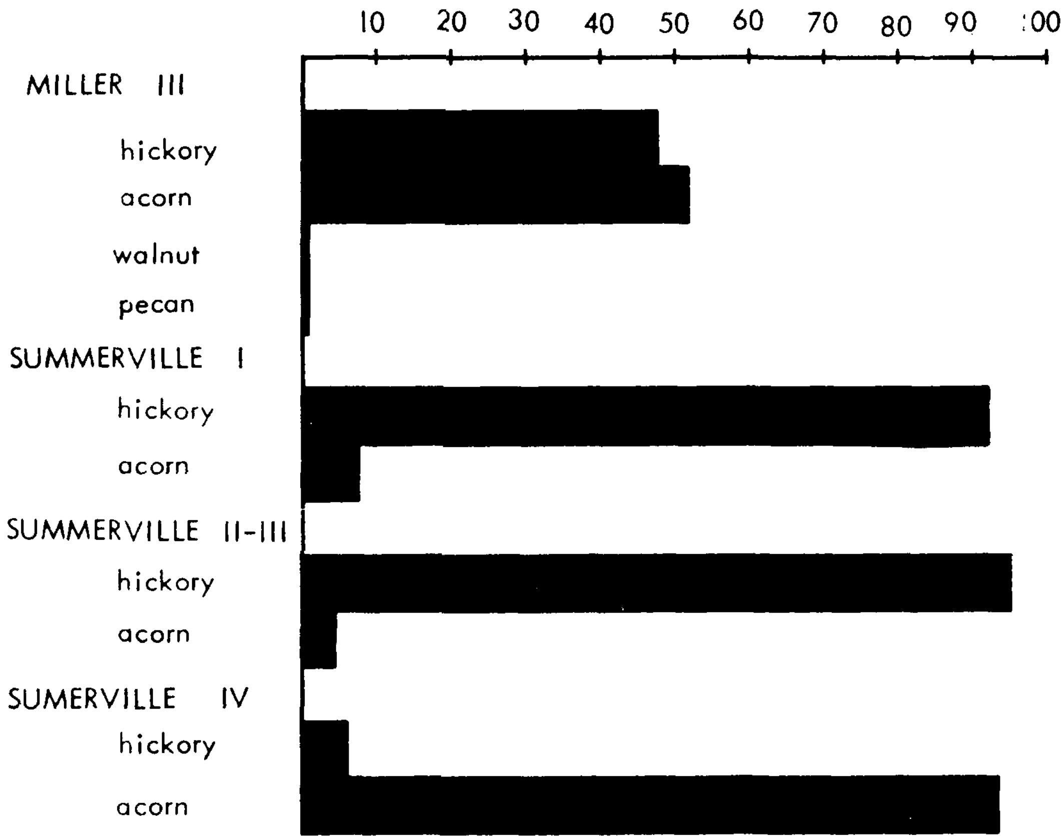

Figure 3. Percent occurrence of nut types.

TABLE 28

Composition of Foods per 100 Grams.

Food	Water (percent)	Food Energy (Calories)	Protein (g)	Fat (g)	Carbohydrate Total (g)	Carbohydrate Fiber (g)
Corn, field, wholegrain, raw	13.8	348	8.9	3.9	72.2	2.0
Hickory nuts	3.3	673	13.2	68.7	12.8	1.9
Black walnuts	3.1	628	20.5	59.3	14.8	1.7
Acorns white oak	47.3	221	2.8	3.3	43.9	1.3
Red oak	38.2	299	3.4	12.9	42.1	1.9

Sources: Watt and Merrill 1963; Wainio and Forbes 1941.

Hickory nuts, acorns, and black walnuts would have all been available in forests in the immediate vicinity of the Lubbub Creek Archaeological Locality. Hickory trees and several species of oak trees were among the most numerous trees recorded for the area by the General Land Office surveyors in the early nineteenth century (Caddell 1979). Walnut trees were much less numerous in this region.

Although a variety of nut-bearing trees were present, not all would have produced good crops each year. Individual hickory trees produce a good crop from once a year to once in five years. Walnut trees produce good crops irregularly, on the average about two good crops in five years. Frequencies of good crops for oak trees vary from almost every year to one crop every ten years for individual oak trees (U.S.D.A. Forest Service 1948; Fowells 1965).

Man would have had to compete with squirrels and other animals for all the nut crops. Also, according to Schopmeyer (1974):

> Acorns of the white oak group should be collected soon after they have fallen to retard early germination...In addition, birds eat ripe acorns of some species while they are still on the tree, and several organisms consume acorns rapidly once they have fallen. In years when light crops are produced, acorns are sometimes heavily infested with weevils (Cucurlio sp.), and collection of large quantities of sound seed is difficult (Schopmeyer 1974:698).

Schopmeyer (ibid:699) further notes that most species of white oak acorns should not be stored since they "germinate almost immediately after falling," nor should black oak acorns be stored longer than six months. Hickory nuts and black walnuts could have been stored from one year to the next, under the proper conditions.

Hickory nuts require the least processing of all the nuts. Their husks split apart, but those of black walnuts do not. The tannins in acorns of the red oak group must be removed by leaching before the acorns are edible.

In terms of their availability, the amount of processing required, and their nutritional content, hickory nuts were probably the most attractive of the nuts available to the prehistoric populations of the Lubbub Creek Archaeological Locality.

Asch et al (1972) remarked on the superiority of hickory nuts as a food source in their discussion of the botanical data from the Koster site. Part of their discussion may be relevant to the present study:

> ...with the available technology as a given, a human population will take those food resources which are most easily collected in large quantity and which are most nutritionally complete. Thus, a small population might be able to subsist very well by concentrating on the collection of a few abundant, easy-to-collect, more nutritionally complete foods (Asch et al 1972:27).

The collection of a single type of nut, such as hickory nuts, then, may have been a more efficient subsistence strategy than the collection of several types of nuts which were less nutritious and harder to collect, process, or

store.

In early Woodland times, the populations in the central Tombigbee River valley may have concentrated on the hickory nut harvest. There is little evidence from sites in the area that acorns attained much importance until Miller II times (Caddell 1979). In Miller II and III times, use of both acorns and walnuts apparently intensified. The population was increasing during this time, as evidenced by the larger number and size of sites (Jenkins and Curren 1976). Maize did not yet provide a significant portion of the carbohydrates in the diet, and perhaps, as the population increased, it became necessary to collect more of the other types of nuts in addition to hickory nuts.

With the intensification of maize agriculture in Mississippian times, the collection of these other types of nuts may not have been necessary. During the Summerville I, II, and III periods at the Lubbub Creek Archaeological Locality, the populations apparently derived the major portion of their dietary plant food requirements from the corn harvest (and to an undetermined extent, the harvest of beans) and the collection of hickory nuts. It may have been considerations of the ease with which they were collected, processed, and stored which made hickory nuts the dominant type of nut used during these periods. Moreover, since the carbohydrate content of maize is more similar to acorns than hickory nuts, it is not surprising that utilization of acorns lessened in Mississippian times. Hickory nuts would still have been important as a source of oil, in which both maize and acorns are low.

The collection and processing of acorns may have conflicted with the scheduling of the fall corn harvest more than the collection of other types of nuts. Acorns would have required more immediate collection and processing at around the same time the corn ripened. Hickory nuts could probably have been collected after the cultivated crops were harvested and stored. If planting began as early as late March or April, however, as is possible in Alabama, the maize harvest would not have interfered with the acorn harvest. If two crops were planted, the acorn harvest may have conflicted with the fall, or the second, corn harvest.

Maize apparently supplied a smaller portion of carbohydrates to the diet of the Protohistoric populations at this locale. The dominance of acorns in Summerville IV samples suggests that they may have again, as in Late Woodland times, been an important source of carbohydrates.

It is proposed, then, that maize replaced the nut crops in the diet to a significant extent during the Mississippian period, but hickory nuts were still frequently used, especially for their oil. During the Protohistoric period, as use of maize lessened, acorns attained more importance because of their carbohydrate content. An ethnographic source for the Choctaw lends some support to this argument. Drawing on data compiled by Lincecum, a nineteenth century naturalist, from conversations with a Choctaw informant, Campbell ([illegible]) stated that "... acorn mush (okshush) was an important food when the corn crop was poor."

[illegible]

[illegible] maize [illegible]

TABLE [illegible]
(Continued)

[illegible]	Longitudinal Shape	Row Patterning	Irregular Rows	Row Number	Recovery	Period
[illegible]	[illegible]	MODERATE	ABSENT	[illegible]	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	16	FLOTATION	MILLER III
[illegible]	[illegible]	MODERATE	ABSENT	12	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MILLER III
[illegible]	[illegible]	MODERATE	ABSENT	12	FLOTATION	MILLER III
[illegible]	[illegible]	WEAK	ABSENT	14	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	WEAK	ABSENT	12	FLOTATION	MILLER III
[illegible]	[illegible]	WEAK	ABSENT	12	FLOTATION	MILLER III
[illegible]	[illegible]	MODERATE	ABSENT	16	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	12	WATERSCREEN	MILLER III
[illegible]	[illegible]	WEAK	ABSENT	12	FLOTATION	MILLER III
[illegible]	[illegible]	WEAK	ABSENT	12	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	WEAK	ABSENT	14	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	WATERSCREEN	MILLER III
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	WATERSCREEN	MILLER III
[illegible]	TAPERED	STRONG	ABSENT	12	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	WEAK	PRESENT	10	FLOTATION	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MILLER III
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MILLER III
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	14	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	PRESENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	10	FLOTATION	SUMMERVILLE II AND III
[illegible]	CYLINDRICAL	WEAK	ABSENT	12	FLOTATION	SUMMERVILLE II AND III
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	SUMMERVILLE II AND III
[illegible]	CYLINDRICAL	STRONG	ABSENT	8	FLOTATION	SUMMERVILLE II AND III
[illegible]	CYLINDRICAL	STRONG	ABSENT	12	FLOTATION	SUMMERVILLE II AND III
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	SUMMERVILLE II AND III
[illegible]	CYLINDRICAL	STRONG	ABSENT	8	FLOTATION	SUMMERVILLE II AND III
[illegible]	CYLINDRICAL	STRONG	ABSENT	12	FLOTATION	SUMMERVILLE II AND III
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	SUMMERVILLE II AND III
[illegible]	CYLINDRICAL	WEAK	ABSENT	10	FLOTATION	SUMMERVILLE II AND III

TABLE 31
(Continued)

[illegible]	Fragment Type	Cupule Width mm	Internode Length mm	Glume Width mm	Maximum Cob Diameter mm	Minimum Cob Diameter mm	Cross Section Shape	Fragment Length mm
[illegible]	MIDSECTION TO TIP	5.6	3.5	3.3	10.2	7.7	CIRCULAR	38.4
8912	MIDSECTION	4.3	3.2	2.7	11.6	10.5	CIRCULAR	29.9
8912	MIDSECTION	4.7	2.9	3.0	12.4	8.8	CIRCULAR	25.2
8912	MIDSECTION	4.9	2.8	2.5	8.1	6.4	CIRCULAR	13.5
8912	MIDSECTION	5.1	3.3	3.1	10.2	8.1	CIRCULAR	17.9
8912	MIDSECTION	5.4	3.1	4.1	16.9	12.9	CIRCULAR	57.3
8912	MIDSECTION	5.5	3.8	3.6	12.0	8.7	ELLIPTICAL	19.1
8912	MIDSECTION	5.6	3.6	3.5	10.1	8.9	CIRCULAR	19.1
8912	MIDSECTION	5.8	3.2	3.1	15.0	10.6	CIRCULAR	56.8
8912	MIDSECTION	5.8	3.3	3.1	9.1	8.4	CIRCULAR	13.3
8912	MIDSECTION	5.9	3.2	---	7.3	6.4	QUADRANGULAR	14.5
8912	MIDSECTION	6.0	3.3	3.1	9.3	9.0	CIRCULAR	20.0
8912	MIDSECTION	6.0	3.4	3.6	11.5	10.9	CIRCULAR	18.2
8912	MIDSECTION	6.0	3.6	3.8	11.0	9.7	CIRCULAR	24.0
8912	MIDSECTION	6.2	3.3	3.5	12.8	9.0	ELLIPTICAL	49.2
8912	MIDSECTION	6.2	3.7	4.5	15.1	12.1	CIRCULAR	38.4
8912	MIDSECTION	6.3	3.1	---	7.1	7.0	QUADRANGULAR	15.1
8912	MIDSECTION	6.7	2.8	4.4	11.0	10.3	CIRCULAR	17.0
8912	MIDSECTION	6.7	3.3	4.1	13.2	12.0	CIRCULAR	22.0
8912	MIDSECTION	7.0	3.0	3.9	11.7	9.8	CIRCULAR	12.4
8912	MIDSECTION	7.0	3.2	3.7	14.4	11.0	ELLIPTICAL	35.5
8912	MIDSECTION	7.0	4.6	3.9	12.1	11.8	CIRCULAR	17.1
8912	MIDSECTION	7.4	3.1	4.0	13.1	10.4	ELLIPTICAL	38.0
8912	MIDSECTION	8.6	3.0	---	11.1	9.8	QUADRANGULAR	16.9
8968	MIDSECTION	8.0	3.9	4.9	14.3	12.1	ELLIPTICAL	40.7
[illegible]	MIDSECTION TO TIP	5.6	3.6	3.5	9.1	7.1	CIRCULAR	13.8
9011	MIDSECTION	4.8	2.4	3.4	8.8	6.2	---	13.8
9011	MIDSECTION	4.8	3.2	3.7	10.5	6.9	CIRCULAR	32.3
9011	MIDSECTION	5.8	2.9	3.5	11.0	9.7	CIRCULAR	24.2
9011	MIDSECTION	6.0	3.1	3.8	11.0	9.0	CIRCULAR	28.7
9011	MIDSECTION	6.2	3.0	3.6	13.5	7.6	CIRCULAR	19.4
9011	MIDSECTION	6.2	3.3	4.2	10.1	7.8	CIRCULAR	20.9
9011	MIDSECTION	6.6	3.4	3.7	15.2	12.4	ELLIPTICAL	39.1
9011	MIDSECTION	7.7	3.8	4.0	13.7	10.2	CIRCULAR	46.6
9019	MIDSECTION	5.3	3.2	3.5	10.0	8.7	CIRCULAR	17.9
9031	MIDSECTION TO TIP	5.2	3.3	3.9	6.0	5.8	QUADRANGULAR	11.9
9031	MIDSECTION TO TIP	6.2	3.1	3.6	8.0	4.9	QUADRANGULAR	18.4
9034	MIDSECTION	5.6	3.5	4.1	7.5	6.8	QUADRANGULAR	13.5
9034	MIDSECTION	6.6	3.0	3.9	8.0	6.6	QUADRANGULAR	33.7
9315	MIDSECTION	5.4	2.9	3.2	9.7	8.6	CIRCULAR	19.6
9315	MIDSECTION	6.5	3.4	3.9	11.0	10.1	CIRCULAR	25.0
9315	MIDSECTION	6.7	2.8	4.3	9.0	8.7	QUADRANGULAR	13.9
9315	MIDSECTION	6.7	3.0	4.2	8.8	8.6	QUADRANGULAR	30.0
9315	MIDSECTION	6.9	3.8	4.1	14.3	12.1	CIRCULAR	16.0
9315	MIDSECTION	7.4	3.1	4.7	9.2	8.3	QUADRANGULAR	33.7
9315	MIDSECTION	7.4	3.2	4.0	8.8	8.4	QUADRANGULAR	18.8
9315	MIDSECTION	7.7	3.8	4.3	14.7	12.1	ELLIPTICAL	16.7
9121	MIDSECTION	6.5	4.2	5.1	11.0	9.0	CIRCULAR	30.9
9131	MIDSECTION	6.8	3.2	5.5	11.2	10.1	CIRCULAR	23.2

TABLE 31
(Continued)

[illegible]	Longitudinal Shape	Row Pairing	Irregular Rows	Row Number	Recovery	Period
[illegible]	TAPERED	WEAK	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	CIGAR	WEAK	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	CIGAR	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	PRESENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	10	WATERSCREEN	MIXED
[illegible]	TAPERED	STRONG	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	STRONG	ABSENT	8	WATERSCREEN	SUMMERVILLE II AND III
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	[illegible]	MODERATE	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	SUMMERVILLE I
[illegible]	CYLINDRICAL	WEAK	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	CIGAR	WEAK	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	[illegible]	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	CIGAR	MODERATE	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	PRESENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	WEAK	ABSENT	10	WATERSCREEN	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	MILLER III
[illegible]	TAPERED	WEAK	ABSENT	8	WATERSCREEN	MILLER III
[illegible]	TAPERED	WEAK	ABSENT	10	WATERSCREEN	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	10	WATERSCREEN	MILLER III
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MILLER III

TABLE 31
(continued)

No.	Fragment Type	Cupule Width mm	Internode Length mm	Glume Width mm	Maximum Cob Diameter mm	Minimum Cob Diameter mm	Cross Section Shape	Fragment Length mm
[illegible]	MIDSECTION TO TIP	5.0	2.8	[illegible]	5.2	3.7	QUADRANGULAR	16.1
[illegible]	MIDSECTION TO BUTT	4.3	[illegible]	2.2	5.9	[illegible]	CIRCULAR	12.5
[illegible]	MIDSECTION	5.1	2.9	4.7	8.4	[illegible]	CIRCULAR	18.3
[illegible]	MIDSECTION	5.6	[illegible]	4.2	6.9	6.8	QUADRANGULAR	27.7
[illegible]	MIDSECTION TO BUTT	6.9	3.2		[illegible]	8.1	ELLIPTICAL	19.2
[illegible]	MIDSECTION	5.1	2.8	[illegible]	8.4	7.2	ELLIPTICAL	15.1
4389	MIDSECTION	4.1	2.4	2.4	[illegible]	[illegible]	CIRCULAR	21.7
4389	MIDSECTION	4.5	3.1	3.4	8.9	[illegible]	CIRCULAR	12.3
4389	MIDSECTION	5.6	2.8	2.8	[illegible]	6.1	CIRCULAR	22.5
[illegible]	TIP	3.5	2.5		[illegible]	[illegible]	CIRCULAR	11.6
5208	MIDSECTION	6.3	3.1	[illegible]	[illegible]	[illegible]	CIRCULAR	18.1
5208	MIDSECTION	6.7	3.3	[illegible]	[illegible]	[illegible]	QUADRANGULAR	10.1
5208	MIDSECTION	7.4	[illegible]	[illegible]	[illegible]	[illegible]	CIRCULAR	23.3
5208	MIDSECTION	8.6	3.4	[illegible]	[illegible]	[illegible]	QUADRANGULAR	24.4
5248	MIDSECTION	6.6	3.3	[illegible]	[illegible]	[illegible]	CIRCULAR	30.5
5250	MIDSECTION	6.2	2.5	3.8	[illegible]	[illegible]	CIRCULAR	10.1
5262	MIDSECTION	5.2	3.4	3.8	[illegible]	6.5	CIRCULAR	13.2
5262	MIDSECTION	5.7	2.9	[illegible]	[illegible]	[illegible]	QUADRANGULAR	13.0
5262	MIDSECTION	7.5	2.8	[illegible]	9.5	[illegible]	QUADRANGULAR	20.0
5669	MIDSECTION	9.0	2.9	[illegible]	[illegible]	[illegible]	CIRCULAR	16.5
5672	MIDSECTION	4.0	2.6	2.7	[illegible]	[illegible]	ELLIPTICAL	19.0
5672	MIDSECTION TO BUTT	4.3	3.0	[illegible]	[illegible]	[illegible]	QUADRANGULAR	18.1
6154	MIDSECTION TO TIP	5.5	3.2	[illegible]	[illegible]	4.9	QUADRANGULAR	13.6
6154	MIDSECTION	4.7	3.0	3.1	[illegible]	6.8	CIRCULAR	21.3
6154	MIDSECTION	5.2	2.7	[illegible]	[illegible]	7.2	CIRCULAR	7.8
6154	MIDSECTION	5.8	2.7	3.6	7.9	6.6	QUADRANGULAR	14.3
6154	MIDSECTION	6.5	2.9	4.3	11.0	8.6	CIRCULAR	21.6
6162	MIDSECTION	5.3	---	---	7.8	--	CIRCULAR	3.0
6165	MIDSECTION	5.3	3.0	4.0	8.0	7.1	CIRCULAR	13.2
6165	MIDSECTION	5.9	2.8	4.1	9.5	7.8	CIRCULAR	16.8
6165	MIDSECTION	6.1	3.3	4.4	9.1	8.9	CIRCULAR	20.5
6165	MIDSECTION	6.2	3.5	3.7	7.4	6.1	QUADRANGULAR	16.4
6165	MIDSECTION	6.6	2.8	4.0	10.3	9.1	CIRCULAR	17.0
6165	MIDSECTION	6.6	3.0	3.7	7.3	6.6	QUADRANGULAR	24.1
6165	MIDSECTION TO BUTT	6.4	2.9	4.0	8.4	7.5	QUADRANGULAR	14.0
6165	MIDSECTION TO BUTT	8.0	3.4	[illegible]	11.3	11.2	CIRCULAR	31.6
[illegible]	MIDSECTION	5.7	3.4	3.1	11.4	8.0	ELLIPTICAL	18.2
6185	MIDSECTION	6.0	3.4	3.2	7.2	5.7	QUADRANGULAR	16.8
6189	MIDSECTION TO TIP	3.3	2.1	2.0	4.9	3.9	CIRCULAR	8.5
6189	MIDSECTION	4.9	3.1	3.0	8.1	7.3	CIRCULAR	13.3
7169	MIDSECTION	6.1	2.5	---	11.3	8.1	ELLIPTICAL	24.2
7169	MIDSECTION	7.1	3.1	4.5	8.9	8.1	QUADRANGULAR	25.6
7169	MIDSECTION	7.3	3.1	4.2	8.9	8.7	QUADRANGULAR	19.9
8108	MIDSECTION	4.5	2.9	3.1	8.1	7.2	CIRCULAR	16.7
8108	MIDSECTION	4.6	3.5	2.7	7.6	7.3	CIRCULAR	15.8
8439	MIDSECTION	6.3	3.1	3.8	9.1	7.5	ELLIPTICAL	24.9
8587	MIDSECTION	4.4	2.8	4.0	8.1	8.0	CIRCULAR	20.2
8587	MIDSECTION	5.3	3.0	3.2	6.1	5.0	QUADRANGULAR	17.1
8587	MIDSECTION	6.7	3.1	4.3	9.0	8.2	ELLIPTICAL	23.3
8587	MIDSECTION	8.0	3.8	5.0	13.0	11.6	ELLIPTICAL	25.9
8587	MIDSECTION	8.1	3.3	5.1	14.7	13.2	CIRCULAR	16.4
8912	MIDSECTION TO TIP	5.2	3.2	3.9	9.0	7.1	CIRCULAR	39.0

TABLE 31
(Continued)

[illegible]	[illegible] Shape	Row Patterning	Irregular Rows	Row Number	Recovery	Period
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	14	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	14	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	12	FLOTATION	SUMMERVILLE II AND III
[illegible]	TAPERED	MODERATE	ABSENT	10	WATERSCREEN	SUMMERVILLE II AND III
[illegible]	TAPERED	WEAK	ABSENT	12	WATERSCREEN	MIXED
[illegible]	CIGAR	WEAK	ABSENT	12	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	8	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	8	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	--	PRESENT	10	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	SUMMERVILLE I
[illegible]	CIGAR	MODERATE	ABSENT	10	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	8	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	8	FLOTATION	SUMMERVILLE I
[illegible]	CIGAR	WEAK	ABSENT	8	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	12	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	SUMMERVILLE I
[illegible]	CIGAR	WEAK	ABSENT	10	FLOTATION	SUMMERVILLE I
[illegible]	TAPERED	WEAK	ABSENT	8	WATERSCREEN	SUMMERVILLE I
4118	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
4118	TAPERED	WEAK	ABSENT	12	FLOTATION	MISSISSIPPIAN
4118	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
4118	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	CYLINDRICAL	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	PRESENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	10	WATERSCREEN	SUMMERVILLE IV
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MIXED
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MIXED
[illegible]	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
[illegible]	TAPERED	STRONG	ABSENT	8	WATERSCREEN	SUMMERVILLE IV
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	SUMMERVILLE IV
[illegible]	TAPERED	STRONG	ABSENT	8	WATERSCREEN	SUMMERVILLE IV
[illegible]	TAPERED	STRONG	ABSENT	10	WATERSCREEN	MISSISSIPPIAN

TABLE 31
(Continued)

FSN	Fragment Type	Cupule Width mm	Internode Length mm	Glume Width mm	Maximum Cob Diameter mm	Minimum Cob Diameter mm	Cross Section Shape	Fragment Length mm
3266	MIDSECTION	5.0	3.2	3.1	10.5	8.2	CIRCULAR	18.7
3266	MIDSECTION	6.3	3.4	4.9	12.6	11.9	CIRCULAR	57.3
3281	MIDSECTION TO TIP	4.7	3.5	3.5	10.0	6.4	CIRCULAR	32.3
3281	MIDSECTION	5.5	3.2	3.0	11.1	10.5	CIRCULAR	16.2
3281	MIDSECTION	6.3	2.7	3.1	10.2	8.3	CIRCULAR	20.0
3342	MIDSECTION	4.6	3.0	3.0	10.5	8.5	ELLIPTICAL	22.2
3342	MIDSECTION	4.7	2.6	2.6	10.5	9.2	ELLIPTICAL	17.8
3342	MIDSECTION	5.2	3.0	3.0	9.6	8.7	ELLIPTICAL	20.0
3342	MIDSECTION	5.2	3.0	3.2	6.8	5.9	QUADRANGULAR	21.1
3547	MIDSECTION	5.6	3.3	2.9	8.9	6.7	ELLIPTICAL	25.8
3597	MIDSECTION	6.0	3.2	2.8	9.2	7.1	ELLIPTICAL	18.5
3760	MIDSECTION TO TIP	3.9	2.8	---	6.3	5.5	CIRCULAR	12.8
3958	WHOLE	4.3	4.3	2.7	12.8	---	ELLIPTICAL	40.8
3958	TIP	3.9	2.9	2.8	5.1	4.2	QUADRANGULAR	13.6
3958	TIP	4.1	2.6	3.4	6.0	1.0	QUADRANGULAR	17.7
3958	TIP TO MIDSECTION	3.5	2.7	---	4.9	4.4	ELLIPTICAL	10.8
3958	TIP TO MIDSECTION	5.6	2.7	3.0	8.9	5.0	ELLIPTICAL	16.9
3958	MIDSECTION TO TIP	4.2	2.8	2.6	7.5	5.3	CIRCULAR	24.5
3958	MIDSECTION TO TIP	4.4	2.9	3.2	5.7	3.3	CIRCULAR	24.4
3958	MIDSECTION TO TIP	6.0	3.6	4.2	7.2	5.5	CIRCULAR	23.6
3958	MIDSECTION TO TIP	6.2	3.1	3.5	8.6	5.3	QUADRANGULAR	21.5
3958	MIDSECTION	3.4	2.4	2.1	4.3	4.0	QUADRANGULAR	7.4
3958	MIDSECTION	4.9	3.0	3.0	6.3	3.6	CIRCULAR	14.1
3958	MIDSECTION	5.0	2.7	4.0	9.6	6.7	CIRCULAR	18.3
3958	MIDSECTION	5.0	3.1	3.8	12.0	7.5	CIRCULAR	22.7
3958	MIDSECTION	5.6	2.5	3.3	8.1	6.0	QUADRANGULAR	12.6
3958	MIDSECTION TO BUTT	5.6	3.6	4.6	9.3	5.7	ELLIPTICAL	22.5
4075	MIDSECTION	6.1	3.3	4.0	9.0	7.0	CIRCULAR	18.6
4118	MIDSECTION TO TIP	4.4	2.6	3.7	7.4	5.8	QUADRANGULAR	23.1
4118	MIDSECTION TO TIP	4.9	3.2	3.3	8.7	8.1	CIRCULAR	27.3
4118	MIDSECTION	3.5	3.0	---	6.2	6.0	CIRCULAR	16.7
4118	MIDSECTION	4.4	2.5	2.7	8.9	8.1	CIRCULAR	20.2
4118	MIDSECTION	4.8	3.3	3.3	8.0	7.2	CIRCULAR	14.4
4118	MIDSECTION	4.9	2.9	3.2	7.7	7.1	CIRCULAR	14.4
4118	MIDSECTION	5.4	3.2	3.2	7.0	6.7	QUADRANGULAR	23.6
4118	MIDSECTION	5.5	3.6	3.8	10.2	8.7	ELLIPTICAL	24.8
4118	MIDSECTION	5.6	3.6	3.1	11.2	8.3	ELLIPTICAL	18.7
4118	MIDSECTION	5.7	3.2	3.0	7.8	6.8	QUADRANGULAR	18.6
4118	MIDSECTION	5.9	3.1	3.4	7.3	7.0	QUADRANGULAR	16.6
4118	MIDSECTION	6.3	2.9	---	8.2	7.4	CIRCULAR	11.2
4118	MIDSECTION	6.8	3.3	3.7	7.9	7.4	QUADRANGULAR	25.5
4118	MIDSECTION	6.9	3.2	3.5	9.1	8.2	QUADRANGULAR	25.6
4118	MIDSECTION	7.1	4.0	5.2	11.9	11.5	CIRCULAR	21.2
4118	MIDSECTION TO BUTT	9.0	3.1	4.0	12.7	8.8	QUADRANGULAR	24.7
4125	MIDSECTION TO TIP	4.1	2.8	2.0	7.0	5.0	ELLIPTICAL	17.4
4266	MIDSECTION	4.9	3.1	3.0	8.0	6.0	CIRCULAR	15.0
4266	MIDSECTION	6.2	3.3	3.4	9.5	8.6	ELLIPTICAL	15.6
4270	MIDSECTION	4.7	2.8	3.0	7.5	6.8	CIRCULAR	12.7
4788	MIDSECTION	6.7	3.3	3.5	8.9	8.6	QUADRANGULAR	13.6
4788	MIDSECTION	6.7	3.4	3.8	8.7	8.4	QUADRANGULAR	10.1
4788	MIDSECTION	8.1	3.1	4.6	10.0	8.6	QUADRANGULAR	20.8
4788	MIDSECTION	7.2	3.3	4.3	13.0	9.9	CIRCULAR	39.1

TABLE 31
(Continued)

USN	Longitudinal Shape	Row Pairing	Irregular Rows	Row Number	Recovery	Period
1443	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
1443	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
1443	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
1443	TAPERED	WEAK	ABSENT	12	FLOTATION	MISSISSIPPIAN
1443	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
1443	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
1443	TAPERED	MODERATE	PRESENT	14	FLOTATION	MISSISSIPPIAN
1443	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
1083	---	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
1083	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2384	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
2385	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2385	TAPERED	STRONG	ABSENT	10	FLOTATION	MISSISSIPPIAN
2387	---	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2389	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2389	CYLINDRICAL	---	ABSENT	10	FLOTATION	MISSISSIPPIAN
2389	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2799	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2389	CYLINDRICAL	MODERATE	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
2407	TAPERED	MODERATE	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
2407	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2407	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
2407	TAPERED	WEAK	PRESENT	10	FLOTATION	MISSISSIPPIAN
2181	TAPERED	---	PRESENT	12	FLOTATION	MISSISSIPPIAN
2520	TAPERED	WEAK	ABSENT	12	FLOTATION	SUMMERVILLE I
2632	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2632	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2701	---	---	---	10	WATERSCREEN	MISSISSIPPIAN
2714	TAPERED	WEAK	ABSENT	8	FLOTATION	MISSISSIPPIAN
2714	TAPERED	WEAK	ABSENT	8	FLOTATION	MISSISSIPPIAN
2714	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
2714	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
2714	TAPERED	WEAK	ABSENT	8	FLOTATION	MISSISSIPPIAN
2714	TAPERED	MODERATE	ABSENT	8	FLOTATION	MISSISSIPPIAN
2714	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
2714	TAPERED	MODERATE	ABSENT	12	FLOTATION	MISSISSIPPIAN
2721	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
2721	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
2722	---	MODERATE	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
2722	---	STRONG	ABSENT	10	WATERSCREEN	MISSISSIPPIAN
2806	CYLINDRICAL	MODERATE	ABSENT	8	FLOTATION	SUMMERVILLE II AND III
2922	TAPERED	WEAK	ABSENT	10	FLOTATION	MISSISSIPPIAN
3129	---	STRONG	ABSENT	8	WATERSCREEN	SUMMERVILLE II AND III
3148	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
3148	CYLINDRICAL	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
3148	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
3148	TAPERED	MODERATE	ABSENT	10	FLOTATION	MISSISSIPPIAN
3159	TAPERED	MODERATE	ABSENT	12	WATERSCREEN	MISSISSIPPIAN
[illegible]	TAPERED	MODERATE	ABSENT	8	WATERSCREEN	MISSISSIPPIAN
3195	---	MODERATE	ABSENT	8	WATERSCREEN	SUMMERVILLE I

TABLE 31

Basic Measures of Corn Cobs Recovered from the Lubbub Creek Archaeological Locality.

UFN	Fragment Type	Cupule Width mm	Internode Length mm	Glume Width mm	Maximum Cob Diameter mm	Minimum Cob Diameter mm	Cross Section Shape	Fragment Length mm
1443	MIDSECTION	3.9	2.6	3.2	6.2	4.7	CIRCULAR	19.8
1443	MIDSECTION	4.0	3.3	3.2	8.8	6.8	ELLIPTICAL	17.5
1443	MIDSECTION	4.4	3.1	2.7	7.3	6.8	CIRCULAR	14.9
1443	MIDSECTION	4.5	3.8	3.3	9.4	7.3	CIRCULAR	23.3
1443	MIDSECTION	5.0	3.0	3.6	9.2	6.0	CIRCULAR	20.3
1443	MIDSECTION	5.2	3.2	3.7	8.6	6.1	CIRCULAR	19.9
1443	MIDSECTION	5.2	4.1	3.8	12.2	10.3	ELLIPTICAL	33.0
1443	MIDSECTION	5.3	2.8	3.8	6.8	6.4	QUADRANGULAR	11.7
1689	MIDSECTION	5.1	3.0	---	8.8	8.0	CIRCULAR	10.5
1689	MIDSECTION	5.2	3.0	3.6	8.3	7.2	CIRCULAR	13.1
236[illegible]	MIDSECTION	5.8	3.5	3.7	9.0	8.2	ELLIPTICAL	19.8
238[illegible]	MIDSECTION	5.6	3.3	4.1	10.2	7.8	CIRCULAR	32.5
238[illegible]	MIDSECTION	6.9	3.1	4.0	13.2	12.0	CIRCULAR	31.9
238	MIDSECTION	4.9	2.2	3.0	8.1	7.3	CIRCULAR	7.1
2389	MIDSECTION TO TIP	4.4	2.5	2.5	6.7	6.0	CIRCULAR	12.2
238[illegible]	MIDSECTION	3.7	2.3	2.8	6.6	6.6	ELLIPTICAL	18.9
238[illegible]	MIDSECTION	4.0	2.8	---	6.5	5.1	CIRCULAR	15.2
2389	MIDSECTION	5.2	2.7	3.5	7.5	6.2	ELLIPTICAL	16.1
2389	MIDSECTION	6.0	2.4	3.4	6.9	6.2	QUADRANGULAR	15.9
2407	MIDSECTION TO TIP	4.5	3.3	3.1	8.0	6.6	CIRCULAR	8.3
2407	MIDSECTION	5.7	3.2	---	10.0	9.3	ELLIPTICAL	17.7
2407	MIDSECTION	8.0	2.7	3.5	8.2	7.7	QUADRANGULAR	22.1
2407	BUTT TO MIDSECTION	5.4	2.5	2.8	7.5	4.9	CIRCULAR	30.6
2481	MIDSECTION TO TIP	4.3	---	---	7.7	7.0	CIRCULAR	8.9
2520	MIDSECTION	6.2	3.1	3.6	13.5	9.3	ELLIPTICAL	20.8
2632	MIDSECTION	5.7	3.7	3.3	9.8	9.2	CIRCULAR	19.1
2632	MIDSECTION	6.5	3.5	3.4	12.8	10.1	CIRCULAR	38.7
2704	MIDSECTION	5.5	---	3.3	10.2	---	---	6.5
2714	TIP	3.0	2.6	2.9	4.1	3.6	QUADRANGULAR	8.5
2714	TIP	3.9	2.8	2.7	4.8	3.9	QUADRANGULAR	12.4
2714	MIDSECTION TO TIP	3.4	2.6	2.9	4.7	4.3	CIRCULAR	14.2
2714	MIDSECTION TO TIP	3.9	2.8	2.3	6.2	4.4	CIRCULAR	13.2
2714	MIDSECTION TO TIP	4.0	2.7	3.0	5.0	3.7	QUADRANGULAR	14.8
2714	MIDSECTION TO TIP	4.1	2.9	2.5	5.0	4.1	ELLIPTICAL	12.5
2714	MIDSECTION TO TIP	4.3	2.9	3.3	6.7	5.7	CIRCULAR	16.8
2714	MIDSECTION	7.2	3.6	3.9	11.8	9.7	CIRCULAR	33.4
2721	MIDSECTION TO TIP	4.5	3.3	---	7.7	5.9	ELLIPTICAL	14.0
2721	MIDSECTION	6.2	2.7	3.4	10.0	7.8	CIRCULAR	27.0
2722	MIDSECTION	5.8	3.6	2.8	9.8	9.4	CIRCULAR	7.7
2722	MIDSECTION	6.5	3.6	3.3	10.6	10.0	CIRCULAR	7.2
2896	MIDSECTION	4.3	3.2	3.2	5.4	4.9	QUADRANGULAR	8.1
2922	MIDSECTION TO TIP	5.7	2.6	3.2	6.9	6.4	CIRCULAR	20.0
3129	MIDSECTION	3.9	2.2	---	5.4	5.4	CIRCULAR	4.4
3148	MIDSECTION	5.1	3.1	3.0	8.6	8.3	CIRCULAR	14.0
3148	MIDSECTION	5.6	3.5	3.8	8.7	7.7	CIRCULAR	39.8
3148	MIDSECTION	5.7	3.0	3.6	9.0	8.6	CIRCULAR	14.5
3148	MIDSECTION	6.0	3.5	3.2	10.0	8.7	CIRCULAR	20.6
3159	MIDSECTION	6.1	2.6	3.7	11.9	9.8	CIRCULAR	20.2
3159	MIDSECTION	6.3	2.9	3.1	8.8	6.9	QUADRANGULAR	10.1
3195	TIP	2.9	---	---	5.3	---	QUADRANGULAR	4.6

it came from the tip or the base of the cob. When the tip was present, a T was recorded, or T-M, depending on the length of the segment. When the base of the cob was present, a B, or B-M was recorded. If a midsection fragment tapered towards the top, M-T was recorded, and if it tapered towards the bottom, M-B was recorded. No flaring was observed at the butt ends of any fragments. Although the fragment type is often a subjective observation, it is very useful. When computing averages for a group of cobs, I found that the midsection fragments were best to use because the tips and butts do not supply measurements typical of the cobs from which they came.

Another subjective observation scores the cross-section shape of the cob. The shape was recorded as C, Q, or E, depending on whether it was circular, quadrilateral, or ellipitical. Often, the presence of glumes distorted the shape, and an attempt was made to ignore the glumes when making this observation. Pressure after deposition may have distorted some cobs, causing them to be elliptical.

Longitudinal shape was also systematically recorded. If the segment tapered towards the tip, T was recorded, and if the segment was straight, an S was recorded. Cigar-shaped cobs were noted by a C; this value was recorded if the cob tapered toward both ends, or if it tapered towards the butt. For the latter, it was assumed that any fragment which tapered towards the butt was from a cob which also tapered towards the tip.

The row number was determined by counting the vertical rows of glumes on the cob section. The presence of any irregular rows was also noted. Using Ford's (1973:189) criteria, the degree of row pairing was recorded: a + was used if a narrow groove separated adjacent cupules, an S for strongly paired, if the groove was wide, and a W for weakly paired, if the cupule corners overlapped.

The maximum and minimum diameters of each fragment were measured. These were taken from the outside of the cupules, so they are measures of the rachis diameter. Cupule width was measured on the largest cupule near the mid-point of the cob (Ford 1973; Nickerson 1953). The width of the largest glume at the same point was measured. Internode length, or the distance from the base of one set of lower glumes to the base of the next in the same row was recorded. This measure may be used to compute the number of cupules for a length of the cob. The row number divided by the internode length gives an index of condensation for the cobs (Smith, C.E. 1980:123,138).

The attributes of each maize cob are reported in Table 31. Attributes of the cobs, grouped by cultural association, are reported in Table 32. All measurements ar uncorrected for shrinkage. Experiments by the author indicated that whole cobs shrink by about 30 percent when carbonized. Cutler and Blake (1973) state that shrinkage is about 15 to 25 percent.

Some temporal differences are apparent from the data. There was a decrease in variability in row number from Late Woodland through Mississippian times. The earlier, Late Woodland, assemblage was comprised of eight, ten, twelve, fourteen, and sixteen-rowed cobs; eight, ten, and twelve-rowed were present in the early and Mature Mississippian samples, and only eight and ten-rowed in the Protohistoric sample. The incidence of strong row pairing also increased through time: 3.2 percent of the Late Woodland cobs had strongly

<SCATTER VAR=SAME>

SCATTER PLOT
N= 226 OUT OF 403 4.KER H VS. 2.KER W

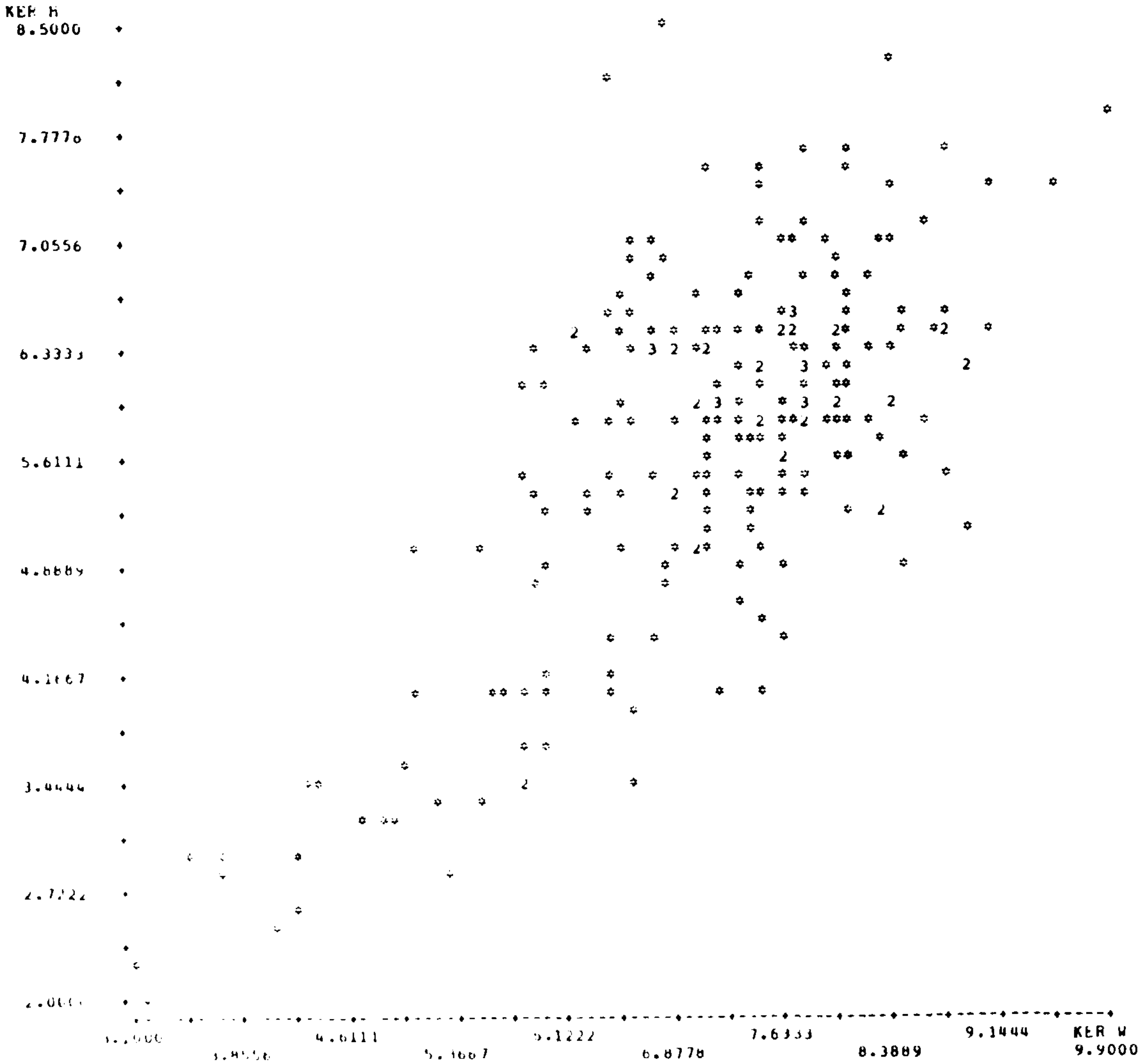

Figure 4. Scatterplot of kernel height vs. width.

TABLE 30

Attributes of Corn Kernels from Flotation Samples.

Cultural Affiliation	Width				Thickness				Height			
	N	Min.	Max.	Mean	N	Min.	Max.	Mean	N	Min.	Max.	Mean
Summerville I	7	4.9	7.6	6.2	7	3.2	5.3	4.4	6	3.4	5.4	4.3
Summerville II-III	64	5.0	9.1	7.4	63	3.0	6.8	4.4	62	4.1	7.7	6.0
Summerville IV	3	4.3	8.6	6.2	3	3.0	6.0	4.7	1	5.8	5.8	5.8
Mississippian	140	3.1	9.8	6.5	135	2.2	7.0	4.2	95	2.0	8.5	5.3
Mixed	19	4.5	9.9	7.3	19	2.9	6.6	4.5	16	5.5	8.2	6.7

TABLE 29

Attributes of Corn Kernels from Waterscreen.

Cultural Affiliation	Width				Thickness				Height			
	N	Min.	Max.	Mean	N	Min.	Max.	Mean	N	Min.	Max.	Mean
Summerville II-III	89	5.7	9.9	7.6	89	3.1	6.7	4.6	23	4.9	6.9	6.1
Mississippian	41	3.4	9.1	7.3	42	3.0	7.0	4.7	12	4.0	7.6	6.1
Mixed	39	5.4	10.1	7.4	39	3.2	7.7	4.6	12	3.7	7.0	5.7

Pits 8 and 26 in Hectare 300N/-200E.

The height, width, and thickness of each kernel were recorded. Kernels were measured if at least two of these measures were obtainable. The width was measured on all but one kernel, and thickness was taken on all but six; height could be obtained for only 227 kernels.

The mean kernel width of all kernels was 7.05 mm, the mean kernel height was 5.71 mm, and the mean kernel thickness was 4.42 mm. There were significant differences between the kernels recovered in the waterscreen and those recovered in the flotation samples (t width=5.49, $p<.0001$; t thickness=3.95, $p<.0001$; t height=1.92, $p<.06$). Kernels from the waterscreen were larger than those from the flotation samples, and there was a greater range of variation in those recovered in the flotation samples. Almost all kernels were missing their embryos, although some embyros were recovered separately.

One hundred sixty-three kernels could be assigned to a cultural period; the remainder could only be assigned to Mississippian or mixed contexts. Dimensions of kernels recovered in the waterscreen are reported, by cultural affiliation, in Table 29. Attributes of those kernels recovered in flotation samples are reported in Table 30, also by cultural affiliation.

No measurable kernels were recovered from Late Woodland contexts, and the early Mississippian (Summerville I) and Protohistoric (Summerville IV) samples were rather small. Consequently, interpretations based on these samples are tenuous. Only the Summerville II and III kernels and those from general Mississippian contexts may be described.

Almost all kernels, with few exceptions, were wider than high. A scatterplot of all kernels is given in Figure 4. Kernels were plotted if both their height and width were measurable. Some kernels were isodiametric, but only a few were higher than wide.

Most of the kernels from the Lubbub Creek Archaeological Locality appear to be Northern Flint. They tend to be crescent-shaped, with their width exceeding their height -- characteristics which are typical of Northern Flint kernels.

Maize Cobs

Two hundred and two corn cob fragments and a single complete cob were recovered during the Lubbub excavations. One hundred fifty-one cob fragments were from smudge pits, twenty-two were from other types of pits, thirteen were from postmolds, six were from structure cuts, three were from excavation units, five were from a wall trench, one was from a burial pit, and one was from redeposited fill from the mound. The complete cob was from a smudge pit. This sample of cob fragments is one of the largest reported from the Southeast.

Attributes of each fragment were recorded. The length of each cob fragment was measured, and an attempt was made to determine what section of a cob each fragment represented. Following Ford (1973:189), the fragment type was recorded. [illegible] M[illegible], if there was no indication that

sites in the lower Southeast. As Ford (1976:9-10) stated: "We know that ethnographic cultures living in the Southeast raised a number of varieties of corn, but to date the phenotypic traits used to define these types have not been distinguished for analyzing carbonized archaeological remains." Archaeological data from the Southwest, Midwest, and Northeast, however, have allowed researchers to describe some types of maize which were present prehistorically in the Eastern United States.

The most widespread type of maize, at least for several centuries prior to European contact, was Northern Flint (Brown and Anderson 1947). Yarnell (1964:107) stated that it is "perhaps the most easily recognized of any archaeological corn..." Cobs are cylindrical, large, and frequently have a flaring butt. They usually have eight or ten rows of wide, crescent-shaped kernels, and exhibit strong row pairing (Brown and Anderson 1947). Corn of the Northern Flint type has been identified from several Alabama sites (Brown and Anderson 1947; Cutler and Blake 1973; Neuman 1961; Caddell 1979).

Another type of corn found earlier on archaeological sites in the Eastern United States is a type which resembles the Basketmaker corn of the Southwest (Brown and Anderson 1947; Yarnell 1964). These cobs are elliptical and taper toward both the tip and the butt; row pairing is absent, and they are typically 12- or 14-rowed. To my knowledge, this type of corn has not been reported for Alabama. It has been reported for several Middle Mississippian sites, including Cahokia, and from the Ozark Bluff Shelters (Yarnell 1964).

The earliest types of corn found archaeologically in the eastern United States are small flints or popcorns (Cutler and Blake 1974:62). These cobs are tapered and usually have 12 or 14 rows of pop or flint grains.

The large sample of maize cobs recovered from the Lubbub Creek Archaeological Locality and from earlier excavations in the central Tombigbee River valley should provide much information on the types of corn grown in this area.

Earlier excavations in the central Tombigbee River valley produced measurable maize cobs from Sites 1Pi61, 1Gr2, 1Pi12, and 1Pi33 (Smith, C.E. 1975; Caddell 1979). Sites 1Pi12 and 1Pi33 are located within the Lubbub Creek Archaeological Locality. The maize cobs from Site 1Pi12 have not been measured. The samples from Sites 1Pi61 and 1Pi33 were very small; only four cobs from each site were measurable. Those from Site 1Pi61 were ten and twelve-rowed; all cobs from Site 1Pi33 were twelve-rowed. The sample from Site 1Gr2 was considerably larger. One hundred and two measurable cobs were recovered from the 1974 and 1976 excavations. Most of the cobs (84 percent) were ten and twelve-rowed, and there were smaller percentages of eight, fourteen and sixteen-rowed cobs. Mean row number was 10.82.

Maize Kernels

Four hundred and three maize kernels were measured. These kernels were recovered from excavation units, smudge pits, other pits, postmolds, structure cuts, daub zones, midden samples, and hearths, but over 80 percent were from either pits or smudge pits. All measurable kernels recovered in the waterscreened and flotation samples were measured, except those from two features. Subsamples were taken of the kernels from flotation samples from

TABLE 32

Attributes of Maize Cobs by Cultural Affiliation.

	Row Number										Mean Row #	Mean Cupule Width (mm)	Mean Internode Length (mm)	Mean Glume Width (mm)	Mean Condensation Index
	8		10		12		14		16						
	#	%	#	%	#	%	#	%	#	%					
Miller III (N=31)	5	16.1	14	45.2	8	25.8	2	6.5	2	6.5	10.84	6.17	3.31	3.71	3.30
Summerville I (N=19)	9	47.4	7	36.8	3	15.8	-	-	-	-	9.37	5.05	3.01	3.46	3.17
Summerville II (N=15)	7	46.7	4	26.7	4	26.7		-	-	-	9.60	6.29	3.24	4.08	2.98
Summerville IV (N=5)	3	60.0	2	40.0	-	-	-	-	-	-	8.80	6.56	3.18	3.64	2.79
Mississippian (N=129)	45	34.9	59	45.7	21	16.3	4	3.1	-	-	9.75	5.51	3.06	3.13	3.22
Mixed (N=4)	-	-	3	75.0	1	25.0	-	-	-	-	10.50	4.63	2.93	3.20	3.64

TABLE 32

(Continued)

	Cross-section Shape[1]						Longitudinal Shape						Row Pairing[1]					
	Circular		Quad		Ellip.		Tapering		Straight		Cigar		Weak		Moderate		Strong	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Miller II (N=31)	20	64.5	4	12.9	7	22.6	19	61.3	12	38.7	-	-	11	35.5	19	61.3	1	3.2
Summerville I (N=19)	8	42.1	6	31.6	5	26.3	14	77.8	-	-	4	22.2	13	72.2	5	27.8	-	-
Summerville III (N=15)	7	46.7	5	33.3	3	20.0	6	42.9	8	57.1	-	-	4	26.7	3	20.0	8	53.3
Summerville IV (N=5)	1	20.0	3	60.0	1	20.0	5	100.0	-	-	-	-	-	-	2	40.0	3	60.0
Mississippian (N=129)	73	57.5	34	26.8	20	15.7	96	78.7	22	18.0	4	3.3	37	29.4	76	60.3	13	10.3
Mixed (N=4)	3	75.0	-	-	1	25.0	4	100.0	-	-	-	-	3	75.0	-	-	1	25.0

[1] Attributes indeterminable for some cobs.

paired rows, none of the Summerville I cobs exhibited strong row pairing, 53.3 percent of the Summerville II and III cobs were strongly paired, and 60 percent of those from Summerville IV contexts were strongly paired.

The mean condensation index decreased from 3.30 for the Late Woodland cobs, to 3.17 for the Summerville I cobs, to 2.98 for the Summerville II and III cobs, to 2.79 for the Summerville IV cobs. The mean maximum diameter was highest for the Late Woodland cobs, lowest for the Summerville I cobs, then increased in Summerville II and III, and was slightly lower for the Summerville IV cobs. Cobs from Summerville IV contexts had the largest mean cupule width, and those from Summerville I contexts, the lowest.

The percent of cobs which were quadrilateral in cross-section increased from 12.9 percent of the Late Woodland cobs to 60 percent of the Summerville IV cobs. Circular-shaped cobs decreased from 64.5 percent of the Late Woodland sample to 20 percent of the Summerville IV sample. These changes are associated with the increase in percent of eight-rowed cobs, which are often quadrilateral in cross-section.

It should be kept in mind that only a third of the cob sections could be assigned to a chronological position, and some of the samples, particularly the Protohistoric, are rather small.

Many of the cobs from the Lubbub Creek Archaeological Locality appear to be Northern Flint. This type of corn is predominant in samples from later contexts, although it was also present in the earlier samples. There appears to be a trend through time toward greater use of this type of corn. As mentioned above, cobs from later contexts had lower mean row numbers, wider cupules, lower condensation indices, and more strongly paired rows than those from earlier contexts.

Some cobs which may be of the type similar to Basketmaker corn were also present in the assemblage, from Summerville I and general Mississippian contexts. An example was the whole cob recovered from a Summerville I smudge pit. This cob is small, 12-rowed, elliptical in cross-section, and tapers toward both the tip and the butt. It is not certain that the cigar-shaped cobs in the Lubbub assemblage have affinities to the Basketmaker corn; they may be related to Mexican varieties which have cobs which taper to the butt.

Other types of corn were also present, but with the present state of knowledge about the corn varieties which were present in the southeastern United States, their affinities cannot be determined. Some of the earliest cobs, from a Late Woodland smudge pit, were very large-eared and had high row numbers and low cupule widths.

In an attempt to describe types of maize in the Lubbub Creek assemblage, we used cluster analysis and hoped that this would segregate groups of cobs which possessed many features in common.

Cluster Analysis of Cob Fragments

Maize cobs were grouped on the basis of their morphological similarity using computerized cluster analysis. The one hundred eighty-nine midsection fragments and the single whole cob were included in the analysis. Five

variables which are useful in distinguishing between varieties of maize (Nickerson 1953; Brown and Anderson 1947) were used: cupule width, internode length, maximum diameter of the cob, strength of row pairing, and row number. Standard scores were calculated for each variete, and euclidean distances were calculated for all pairs of cobs. The matrix of distances was then reduced to five clusters of cobs by "Ward's Method," the minimization of the error-sum-of-squares. Attributes of these five clusters are detailed in Table 33.

Although these five clusters cannot be assumed to represent biological varieties, the attributes of some are similar to varieties known to be present prehistorically in the eastern United States. For example, cobs in Cluster 4 had a low mean row number and were mostly eight and ten-rowed; they had a large mean cupule width, moderate to strong row pairing, and most were quadrilateral in cross-section. These attributes are characteristic of Northern Flint corn.

The decrease in variation through time was evident by examination of Table 33. The earliest, Miller III, cobs were scattered throughout all the clusters and thus were extremely variable morphologically. Summerville I cobs displayed less variability. Cobs from Summerville II and III contexts showed even less variation, and those from Summerville IV contexts, the least.

The percentage of cobs in each of the row number categories can be converted into a diversity index for each period as well. This measure, H, which is one member of the family of "Information Statistics," expresses the variability, the unevenness, the lack of predictability in a frequency distribution. It is calculated by taking the negative sum of the product of the percentage of each cell frequency expressed as a decimal fraction times the natural logarithm of that percentage (-Sum pi ln pi). This measure reaches its maximum value when the percentages are equal for all cells and is 0 when all observations are in a single cell. For the Lubbub corn per period:

H maximum = 1.609

H Miller III = 1.359

H "Mississippian" = 1.129

H Summerville I-II = 1.104

H Summerville II-III = 1.062

H Summerville IV = 0.673

In effect, there was a reduction of 50 percent in the diversity of corn between the Late Woodland and the latest of the Mississippian periods.

WOOD IDENTIFICATION

Wood charcoal was identified from hearths and smudge pits. Identifications were made by reference to wood keys and plates in Brown (1928) and Koehler (1917) and a modern wood collection. Wood types were noted only on a presence or absence basis. Pieces were snapped in half to obtain a good cross-section.

TABLE 33

Attributes of Maize Cob Clusters.

Cluster	Row Number										Mean Row #	Mean Cupule Width (mm)	Mean Internode Length (mm)	Mean Glume Width (mm)	Mean Maximum Cob Diameter (mm)
	8		10		12		14		16						
	#	%	#	%	#	%	#	%	#	%					
Cluster 1 (N=43)	-	-	30	69.8	12	27.9	1	2.3	-	-	10.65	5.26	3.09	3.30	9.40
Cluster 2 (N=28)	-	-	8	28.6	13	46.4	5	17.9	2	7.1	12.07	5.71	3.36	3.61	11.67
Cluster 3 (N=24)	4	16.7	12	50.0	8	33.3	-	-	-	-	10.33	7.37	3.53	4.28	12.84
Cluster 4 (N=50)	42	84.0	7	14.0	1	2.0	-	-	-	-	8.36	6.31	3.04	3.69	8.50
Cluster 5 (N=45)	18	40.0	25	55.6	2	4.4	-	-	-	-	9.29	4.69	2.91	3.19	7.02

TABLE 33

(Continued)

	Cross-section shape[1]						Longitudinal shape[1]						Row Pairing					
	Circular		Quad.		Ellip.		Tapering		Straight		Cigar		Weak		Moderate		Strong	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Cluster 1 (N=43)	33	76.7	-	-	10	23.3	29	74.4	10	25.6	-	-	-	-	43	100.0	-	-
Cluster 2 (N=28)	19	67.9	-	-	9	32.1	20	71.4	6	21.4	2	7.1	24	85.7	4	14.3	-	-
Cluster 3 (N=24)	14	58.3	3	12.5	7	29.2	17	70.8	7	29.2	-	-	4	16.7	13	54.2	7	29.2
Cluster 4 (N=50)	16	32.0	34	68.0	-	-	34	69.4	14	28.6	1	2.0	-	-	34	68.0	16	32.0
Cluster 5 (N=45)	26	59.1	10	22.7	8	18.2	35	79.5	4	9.1	5	11.4	34	75.6	9	20.0	2	4.4

[1] Attribute indeterminable for some cobs.

TABLE 33

(Continued)

Cluster	Mean Condensation Index	Cultural Affiliation											
		Miller III		Summerville I		Summerville II-III		Summerville IV		Mississippian		Mixed	
		#	%	#	%	#	%	#	%	#	%	#	%
Cluster 1 (N=43)	3.51	7	16.3	1	2.3	1	2.3	-	-	34	79.1	-	-
Cluster 2 (N=28)	3.61	9	32.1	3	10.7	3	10.7	-	-	12	42.9	1	3.6
Cluster 3 (N=24)	2.95	8	33.3	1	4.2	3	12.5	1	4.2	11	45.8	-	-
Cluster 4 (N=50)	2.77	5	10.0	1	2.0	6	12.0	3	6.0	35	70.0	-	-
Cluster 5 (N=45)	3.25	2	4.4	8	17.8	2	4.4	1	2.2	30	66.7	2	4.4

Some uncarbonized fragments of wood were preserved by copper found in association with Burial 6 in Hectare 400N/-400E (USN 2823). From their locations near the skull, both the wood and copper fragments were probably parts of ear ornaments, possibly earspools. The structure of the wood had been severely altered, and it could only be identified as dicot wood.

Wood charcoal from six hearths was identified. All pieces large enough to be identified were examined. Identifications are listed in Table 34. Pine and cane were the most common wood in the hearths, although a number of other woods were represented.

Wood was a common component of the smudge pits. Wood charcoal was identified from thirty smudge pits, and identifications are reported in Table 35. Pine was the most frequently identified wood, but again, there were a variety of other woods represented, particularly oak, hickory, cane, and bark.

SMUDGE PITS

Features were designated "smudge pits" (Binford 1967) if they were small, roughly circular, shallow pits which contained a high density of any combination of wood, cane, or bark, maize cobs, and pine cones. About a hundred thirty smudge pits were excavated at the Lubbub Creek Archaeological Locality. The contents of 31 were analyzed (Tables 5, 9, 11, and 16).

Maize cobs were the most common fuel used in the smudge pits; they occurred in 29 of the 31 smudge pits analyzed. Wood charcoal was also identified in 29 smudge pits, but it was not as abundant as maize cobs. Pine cone fragments, bark, and cane were components of 12 of these features. Nutshells were present in 20 smudge pits, but always in extremely small amounts.

In general, the kernels had been removed from the cobs before the cobs were placed in these pits. Kernel fragments did occur, however, in 20 smudge pits. They were abundant in only one smudge pit, Pit 8 in Hectare 300N/-200E, in which over 4,400 kernel fragments were identified. From the ratio of cupules to kernel fragments, the kernels apparently were not removed from the cobs prior to their placement in this pit.

CONCLUSIONS

The large sample of plant remains from the Lubbub Creek Archaeological Locality has added much to our knowledge and understanding of prehistoric subsistence in the central Tombigbee River valley. The floral contents of 175 features were analyzed. Although few samples were available from earlier contexts, the majority of the samples were from Late Woodland, Mississippian, and Protohistoric periods and were drawn from a variety of proveniences. This sample has allowed us to describe certain aspects of the subsistence of these late prehistoric populations.

Although all late prehistoric populations used essentially the same types of plant foods, the proportions in which they were utilized apparently changed significantly. Nuts were predominant in Late Woodland contexts, forming over 90 percent of the plant food remains. Acorns and hickory nuts appeared to be equally important. Maize fragments occurred in over half of the Late Woodland

TABLE 34

Wood Charcoal from Hearths, Lubbub Creek Archaeological Locality.

USN	Hickory	Oak	Red Oak Group	White Oak Group	*Ulmaceae*	Pine	Cypress	Conifer	Diffuse-Porous	Cane	Bark
<u>300N/-300E</u>											
3048 Hearth 1	x	-	x	-	x	-	x	x	-	-	-
<u>400N/-300E</u>											
3506 Hearth 3	-	-	-	-	-	x	-	-	-	-	-
<u>500N/-300E (Mound)</u>											
5931 Hearth 1	-	-	-	-	-	-	-	-	-	x	x
6505 Hearth 2	-	-	-	-	-	x	-	-	x	x	-
<u>500N/-400E</u>											
3637 Hearth 1, Zone A	-	-	-	-	-	x	-	-	-	-	-
3873 Hearth 1B, Zone B	-	-	-	x	-	x	-	-	-	-	-
3874 Hearth 1B, Zone C	-	x	-	-	-	x	-	-	x	x	-
3875 Hearth Wall	-	-	-	-	-	x	-	-	-	x	-
3878 Hearth 1A, Zone D	-	-	-	-	-	x	-	-	-	x	-
3879 Hearth 1A, Zone E	-	-	-	-	-	x	-	-	-	-	-

TABLE 35

Wood Charcoal from Smudge Pits, Lubbub Creek Archaeological Locality.

[illegible]	Hickory	Red Oak Group	White Oak Group	Ulmaceae	Persimmon	Cottonwood	*Prunus* sp.	Pine	Diffuse-porous	Ring-porous	Cane	Bark
[illegible]												
[illegible]	-	-	-	-	-	-	-	x	-	-	-	-
[illegible]												
[illegible]	-		-	-	-	-	-	x	-	-	-	-
[illegible]	x	-	-	-	-	-	-	-	-	-	-	-
[illegible]	x	-	-	-	-	-	-	-	-	-	x	-
[illegible] 32		x	-	-	-	-	-	x	-	-	-	-
[illegible]												
[illegible]	-	-	-	-	-	-	-	x	-	-	x	-
[illegible]												
[illegible] 163	-	-	-	-	x?	-	-	-	-	-	-	-
[illegible]												
[illegible] 8	x	-	-	-	-	-	-	-	-	-	-	x
[illegible] 40	-	x	-	-	-	-	-	-	-	-	-	-
[illegible], Zone A	x	-	-	-	-	-	-	-	-	-	-	-
[illegible] E (Mound)												
[illegible]	x	-	-	-	-	-	-	x	-	-	-	-
[illegible] 3	-	-	-	-	-	-	-	x	-	-	x	-
[illegible]												
[illegible]	-	-	-	-	-	-	-	x	-	x	-	x
[illegible]	-	x	-	-	-	-	-	-	-	-	-	-
[illegible]	-	-	-	-	-	-	-	x	-	-	x	-
[illegible]	-	-	-	x	-	-	-	-	-	-	-	-
[illegible]	-	-	-	-	-	-	-	-	x	-	-	-
[illegible]	-	-	x	-	-	-	-	-	-	-	-	-
[illegible]	-	x	-	-	-	-	-	-	-	-	-	x
[illegible]												
[illegible]	-	-	-	-	-	-	-	x	-	x	x	-
[illegible]	-	-	-	x	-	-	x?	-	-	-	-	-
[illegible] 21	-	-	-	-	-	x?	-	x	-	-	-	-
[illegible]	-	-	-	-	-	-	-	-	-	-	-	x
[illegible]	-	-	-	-	-	-	-	-	-	-	-	x
[illegible]	x	-	-	-	-	-	-	-	-	-	-	-

TABLE 35

(Continued)

USN	Hickory	Red Oak Group	White Oak Group	Ulma-ceae	Per-simmon	Cotton-wood	*Prunus* sp.	Pine	Diffuse-porous	Ring-porous	Cane	Bark
600N/-400E												
5208 Pit 18	-	-	-	-	-	-	-	x	-	-	-	-
5383 Pit 59	-	-	-	-	-	-	-	x	-	-	-	-
6154 Pit 83		x	-	-	-	-	-	-	-	-	x	-
6165 Pit 87	-	-	-	x	-	-	-	-	-	-	-	-
6169 Pit 89	-	x	-	-	-	-	-	-	-	-	-	-

features, but they formed less than one percent of the plant food remains. Although maize was probably a supplementary source of carbohydrates, it probably was not used heavily.

In Mississippian samples, maize constituted the largest proportion of plant food remains, but it appeared that nuts, especially hickory nuts, were also consistently used, because nutshells occurred in more features than maize fragments.

The composition of Protohistoric samples was quite different than the Mississippian samples. Nut fragments formed over 85 percent of the plant food remains, and the majority were acorn. Maize fragments ormed the remaining 15 percent of the plant food remains from samples.

In general, then, there seemed to be a large increase in utilization of maize from Late Woodland to Mississippian times, followed by a decrease in its use in Protohistoric times.

At least two cultigens were added to the diet in Mississippian times: sunflower seeds at least by the Summerville I period, and beans by the Summerville II period. Their contributions to subsistence were difficult to assess; if we rely on mere numbers, they did not appear to have been of much importance. Opportunities for their preservation may have been fewer than for other types of plant remains, however. A single possible squash seed was identified from a mixed context.

Utilization of other food resources could be inferred from some of the seeds identified: persimmons, plums. grapes, and maypops were apparently used. None of the starchy edible seeds occurred in quantities which would indicate that they were utilized. The best evidence for utilization of some was their occurrence only in samples which contained other edible items -- corn kernels and nut meats. The numbers and densities of these seeds in samples was fairly consistent between periods. Their actual importance during any period could not be determined.

The largest sample of maize cobs reported for a single site in the state was recovered from the Lubbub Creek Archaeological Locality: two hundred and two maize cob fragments and a single complete maize cob, fro texts ranging from Late Woodland to Protohistoric. A large sample of maiz els was also recovered.

Measurements taken on these cobs fragments yielded data which showed some changes in types of corn utilized through time. Cobs from Late Woodland contexts exhibited the most variability in row number, had the highest mean row number, and the highest mean condensation index. Cobs from later contexts had lower mean row numbers, less variability in row number, lower mean condensation indexes, and exhibited stronger row pairing.

At least two distinct types of maize were identified in the assemblage. Many of the cobs and most of the kernels appeared to be Northern Flint, a type of corn with eight to ten rows of crescent-shaped kernels and wide cupules. A [illegible] cobs [illegible] had characteristics similar to types described as [illegible] were also identified. These cobs tapered [illegible] both the base and the tip

There were other types of maize in the assemblage, and, by using attributes which vary among types of maize, we attempted to segregate them by cluster analysis. Five clusters of cobs resulted. Cobs from Late Woodland contexts were about evenly distributed in the five clusters, while later cobs were more alike and thereby concentrated in fewer clusters.

Identification of wood charcoal from hearths and smudge pits showed that although pine was the most common wood used for fuel, a variety of other woods and cane were also frequently used.

It has been suggested that as human populations increased during Late Woodland times at this locale, certain resources were utilized more intensively than during earlier times. These resources included acorns and walnuts.

Although maize was apparently a supplementary carbohydrate source during Late Woodland times, it did not attain much importance until the early Mississippian period. When it became an important food source, maize took the place of the nut crops to a great extent. Because hickory nuts have a high oil content, they were used throughout the Late Woodland and Mississippian periods. Acorns, however, being low in oil and higher in carbohydrates, may have been much less important during the Mississippian. The collection and processing of acorns may have also interfered with the fall corn harvest, and, as noted by one ethnographic source, acorns may have been important when the corn crop was not successful.

The nut crops may have again been quite important in Protohistoric times at this locale. The data suggests that maize was less important than during Mississippian times, and that acorns were heavily utilized.

In summary, then, the data from the Lubbub Creek Archaeological Locality support the conclusions of previous investigators that the Mississippian societies had a subsistence pattern which focused on agriculture, but which included the gathering of wild plant resources. Only a few new items were added to this pattern in Mississippian times -- beans, sunflowers, and perhaps squash. Other than these items, the same plant foods utilized in Late Woodland times continued to be utilized, but their respective contributions to the diet changed significantly.

CHAPTER 4. ANALYSIS, SYNTHESIS, AND INTERPRETATION OF FAUNAL REMAINS FROM THE LUBBUB CREEK ARCHAEOLOGICAL LOCALITY

Susan L. Scott

Analysis of faunal remains from archaeological sites is crucial to an understanding of man-land relationships. Fauna recovered from prehistoric contexts can elucidate one aspect of the diet of prehistoric peoples, is essential to interpreting the season of occupation, and may aid in monitoring changes in the paleoenvironment, whether induced by climate or by man. Fauna recovered from the Lubbub Creek Archaeological Locality represents one aspect of the adaptation of man to the natural environment between 800 A.D. and 1700 A.D. in he Tombigbee Valley. This time period is of particular interest in subsistence studies because it spans the period of transition from a horticultural to a fully agricultural subsistence base. For this reason, the major focus of this study was on detecting this transition in the archaeological record as it is reflected in the kinds and quantity of animal resources procured.

Following the commitment to agriculture, socio-political complexity increased during the Mississippian period. In west central Alabama, this growth in social complexity is particularly evident in the adjacent river valley at Moundville and other Moundville phase communities (Peebles and Kus 1977; Peebles 1978; Steponaitis 1978). Although the Mississippian village in the Lubbub Creek Archaeological Locality was on the periphery of these developments, it was not unaffected. Mature Mississippian burials at the site suggest that some degree of social ranking existed in the Tombigbee Valley, as well, during this time period (Jenkins 1979a). Therefore, a second goal of this analysis was to determine if the distribution of fauna could potentially be interpreted as reflecting differential access to resources by high ranking members of the community.

In addition to these objectives, the numerous refuse-filled features in the Lubbub Creek Archaeological Locality permitted the examination and interpretation of discrete faunal assemblages as artifacts of specific activities and seasons of use.

MATERIALS AND METHODS

I. Identification and Recording of Faunal Materials

Thanks to the extensive skeletal collections housed in the University of Michigan Museum of Zoology, skeletons of most of the species found in the

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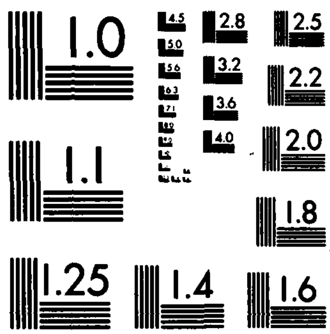

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

research area were available for comparative purposes.[1] The only exceptions to this general statement that are likely to be of any consequence in the following analysis were the lack of adult specimens of either of the species of the genus Graptemys (Map turtles) that are found currently in the Tombigbee drainage. Other than this minor inconvenience, the available comparative materials were beyond reproach. With the particularly large mammal collection, it was possible in many cases to compare the archaeological materials with specimens collected near the study area. The extensive bird collection made possible the identification of two species that are now extinct, passenger pigeon and Carolina parakeet.

Every bone fragment recovered by one-quarter inch hardware cloth was examined, sorted by taxonomic class, counted, and weighed. Due to insufficient time, no attempt was made to record additional information for fauna recovered in the plowzone samples from 10 x 10 m excavation units, postmolds, or Phase I samples. The deletion of this subsample from the following analysis is considered justifiable on several grounds. The deposits either were not completely screened (postmolds and 10 x 10s) or were from plowzone deposits and hence probably mixed (Phase I and 10 x 10s) or were too small to yield firm chronological control (postmolds). The information recorded for these faunal samples is on file at the University of Alabama Office of Archaeological Research.

Bone recovered from features was examined for evidence of modification due to cultural or natural processes (breakage, burning, butchering marks, etc.) and was identified to the lowest possible taxonomic level given the surviving characteristics of the fragment.[2] Nine variables were coded for each bone fragment, including unidentifiable bone. These variables include Unit Serial Number (a provenience designation), taxonomic class, count, weight, reliability of weight, burning, modification, and the origin of fragmentation.[3]

All bone was weighed to tenths of grams excluding some very delicate identifiable bones, generally fish, which were weighed to the hundredth of a gram. Reliability of weight was recorded because in some cases it was obvious that the weight figure did not accurately reflect the weight of the fragment. Some bones were encased in mineral concretions, for example, yielding highly inflated figures. Initially, it was thought that weights of burned bone were also unreliable, based on some experimental evidence to this effect (cf. Baby

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[1]I would like to thank Drs. Gerald Smith (UMMZ Fish Division), Arnold Kluge (UMMZ Herpetology Division), Phillip Myers (UMMZ Mammal Division), and Kent Flannery (UMMA) for allowing me to use the resources at the Museum of Zoology and the Museum of Anthropology.

[2]All identifications were done by the author or Katherine M. Moore, the Lubbub Creek Archaeological Project's research assistant at the University of Michigan Museum of Anthropology. I gratefully acknowledge the assistance of Richard Redding, Dr. Gerald Smith, and Steve Goodman in the identification of particularly difficult pieces.

[3]Coding of the materials was accomplished with the aid of Katherine M. Moore, Judy Bagdon, Virginia Popper, and Katherine Spielmann.

1954). However, it became apparent that a third, unanticipated factor -- highly leached or weathered bone -- was of far greater consequence in skewing the weight of both burned and unburned bone. Unfortunately, this was discovered midway through the analysis, and, as a result, no controls are available.

All burned bone was divided into three color categories according to the assumed intensity and duration of heat: white, blue/gray, and black/brown. If a single fragment exhibited more than one color, it was coded under the color category covering the largest surface area. Additional categories were available for bone that had not been affected by fire and for fragments that were only partially charred.

Coding categories for modified bone included bone tools, ornaments, butchering marks, waste flakes, evidence of carnivore or rodent gnawing, and combinations thereof. Most of these categories are self-explanatory, but it should be pointed out that "waste flakes" are believed to be part of the debris resulting from the breakage of long bones for the extraction of marrow. The fragments interpreted as waste flakes were invariably very small (less than 1 cm), conchoidally fractured long bone shaft fragments. Bone tools and ornaments are described in detail by Anne Woodrick (this chapter, Appendix D).

Origin of fragmentation, the final variable coded for all bones recovered from features, distinguished bones broken prior to deposition from those broken during excavation or shipment. Many fragments exhibited recent breakage as a result of postdepositional leaching compounded by the force of an efficient but extremely powerful water screening system. Whenever possible, pieces were cross-mended and recorded as exhibiting predepositional breakage if the original edges could be discerned.

If the bone was identifiable, an additional nine variables were recorded, including taxon, reliability of the identification, element, side, fusion, fragment size, and four variables describing the location of the fragment in relation to an unbroken element.

In order to be identified to family, genus, or species, the actual element (humerus, femur, etc.) must be recognizable or the fragment must retain some diagnostic character complex unique to a certain taxonomic classification. The reader should be aware that certain taxa, by virtue of their evolutionary history, are more easily identified than others. Some fish, for example, such as bowfins (Amia calva), are the sole surviving members of a very primitive family. Due to the distinctive bony armor of the skull and morphologically primitive vertebrae, almost every skeletal element of a bowfin is recognizable regardless of the size of the fragment. The same is true for members of the gar family (Lepisosteidae), which in addition to distinctive vertebral and skull elements, are covered with very durable bony (ganoid) scales each of which is diagnostic of the family. At the other extreme are members of the sunfish family (bass, crappies, bluegills, etc.), whose skeletons are not only more delicate than the more primitive fishes, but morphologically are extremely difficult to identify to species even with complete elements. Furthermore, it is often difficult to distinguish sunfishes from other closely related families, perch or sea basses, for example. In some cases, the correspondence between an archaeological specimen and a certain species may be suggestive but not conclusive because of the

number of possible alternatives. As a result, the variable for reliability of the identification was included.

Bones considered identifiable in this analysis included all pieces which could be assigned to taxonomic class. General categories such as large mammal (e.g., deer or bear), medium mammal (e.g., raccoon or dog sized), and small mammal (e.g., mouse or rabbit sized), large bird (e.g., turkey sized), medium bird (e.g., duck sized), and small bird (e.g., songbird or quail sized), large carnivore (e.g., wolf or bear), etc., allowed the greatest possible taxonomic resolution for those fragments which were not complete or distinctive enough to allow a more refined classification. Accordingly, general categories were included in the variable for the element represented, such as indeterminate long bone, skull fragment, etc.

Fusion was recorded only for mammals and for specific elements of the turtle skeleton such as costals and peripherals which fuse after full growth is achieved. A distinction was made between mammalian bones that were unfused (epiphysis and diaphysis completely unattached), fusing (epiphyseal lines still visible or epiphysis only partially attached), and fused (epiphyseal lines no longer visible).

Fragment size is a subjective estimate of the size of the archaeological fragment in relation to an unbroken element. Four additional variables, proximal/distal, anterior/posterior, lateral/medial, and dorsal/ventral, further describe the actual portion of the element represented by the identified fragment. Table 1 outlines the manner in which these variables were used to describe specific elements.

The final variable, estimated live weight, was coded only for fish remains. Unlike mammals and birds, fish continually increase in size and weight, making it difficult to arrive at an average weight for any fish species. Each identified element was compared to a series of specimens of that taxon of known length. The estimated length of the archaeological specimen was then converted to an approximate live weight figure, in kilograms, based on data published in Carlander (1952; 1969; 1977). Whenever possible, data from fish populations in the Southeastern United States were used in this conversion. Regardless of this precaution, the calculated weights are subject to error since the actual weight of a fish is heavily dependent on its nutritional state. Each feature on the site was treated as a unit in these live weight conversions, so that if two or more elements of the same species were recovered from a single feature and were potentially from the same individual, live weight was recorded for only one. If the fragment was diagnostic only to family or genus and of unique size, conversion data were drawn from species for which considerable information was available in Carlander, e.g., channel catfish for elements identified as _Ictalurus_ spp. or Ictaluridae.

The coding system used here is a slightly modified version of one developed by Richard Redding, Jane Wheeler Pires-Ferreira, and Melinda A. Zeder (1977) for faunal remains from the Near East. Their coding system was adapted for North America, and certain variables such as "reliability of weight" and "estimated live weight" were added as deemed necessary given the faunal sample from the Lubbub Creek Archaeological Locality. This coding system was used to create the basic structure of a TAXIR data bank.

TABLE 1

Coding System Used for Describing Fragments of Identified Elements.[1]

	Long bones	Mandibles	Skull Fragments	Vertebrae
PROXIMAL-DISTAL	Indeterminate Complete Proximal end Proximal shaft Proximal-end shaft Shaft Distal end-shaft Distal shaft Distal end	Indeterminate Complete Articulation Ramus Articulation ramus Cheek art. area Cheek region Diastema-cheek Symphysis-cheek Diastema-articular Symphysis-diastema Diastema	Indeterminate Complete Proximal end Central region Distal end	Not applicable
ANTERIOR-POSTERIOR	Indeterminate Complete Anterior Posterior	Not applicable	Not applicable	Indeterminate Complete Anterior Posterior
LATERAL-MEDIAL	Indeterminate Complete Lateral Medial	Indeterminate Complete Lateral Medial	Indeterminate Complete Lateral Medial	Indeterminate Complete Right half Left half
DORSAL-VENTRAL	Not applicable	Indeterminate Complete Dorsal Ventral	Not applicable	Indeterminate Complete Arch Centrum

[1]After Redding, Pires-Ferreira, and Zeder (1977).

In the interest of time, mammalian teeth were described in more detail in a second data bank. Variables included identification, symmetry, tooth type (permanent, deciduous), tooth position (upper, lower), tooth class (premolar, etc.), tooth number (1,2,3, etc.), whether or not the tooth had erupted (based on wear and root closure), and whether or not the tooth was recovered in association with either the mandible or maxilla, or adjacent teeth. Had these variables been included in the original data bank, it would have been necessary to code more than 99 percent of the recovered bone fragments for six variables not pertinent to their description. The information from each of these data banks can be found on microfiche as Appendix I in Volume III of this report.

II. Quantification

Numerous quantitative techniques are currently used by faunal analysts to determine the relative abundance of various taxa in archaeological and paleontological assemblages. Until recently, the quantitative technique used most widely in Eastern North American to address both the relative abundance of taxa, and the relative importance of taxa as subsistence items, was minimum numbers of individuals (MNI). Many interpretive problems exist with minimum number values, however. Because skeletal elements are not randomly distributed across an archaeological site, MNI values for taxa in a single archaeological sample may vary considerably depending on the manner in which the sample is subdivided into separate analytic units for computation (cf. Grayson 1979). In addition, MNI values are a function of the number of identified elements per taxon and therefore may vary depending on sample size per taxon within these analytic units (cf. Grayson 1978; 1979). Because of these problems, Grayson (1979:435) concluded that "minimum numbers cannot tell us very much about taxonomic abundances, but what they can tell us is in general also supplied by simple element counts." In this report, counts of identified skeletal elements are the primary measure used to address the relative abundance of taxa identifiable to taxonomic family, genus, or species.

The number of identified specimens per taxon is not a reliable means of assessing the relative importance of taxa as dietary items, however. Not only do taxa differ radically in average meat weight, but fragmentation cannot be assumed to be uniform across taxa due to differences in butchering practices, depositional circumstances, and a host of other factors which will be discussed in more detail below. Instead of fragment counts per taxon, three methods are used in this report to assess the importance of taxa as dietary items: bone weight, skeletal mass allometry (Wing and Brown 1979), and biomass estimates based on minimum numbers of individuals. Bone weight and skeletal mass allometry (which is derived from bone weight) are used to compare seven gross taxonomic categories: large and small mammals, birds, turtles, snakes, amphibians, and fishes. Biomass estimates based on minimum number values are used to assess the relative importance of taxonomic families, genera, and species within each of these classes or suborders.

Skeletal mass allometry is predicated on the fundamental relationship that obtains between the skeletal weight and live weight of vertebrates. As individuals increase in mass, the weight of the skeletal substructure also increases. This relationship is curvilinear and can be expressed mathematically as:

$$\log y = \log a + b \log x$$

Where y = the predicted meat weight
x = the bone weight
a = y intercept; determined empirically per taxon
b = slope of the line; also determined empirically per taxon

Using this formula, the live weight (in kg) represented by a certain quantity of archaeological bone (in kg) can be predicted provided that both the y intercept and the slope of the line are known. Empirical studies (Reitz 1979; Prange et al. 1979) suggest that interspecific variability in this relationship is not pronounced within most taxonomic classes. In other words, the same formula is applicable to both mice and deer, a second formula to both sparrows and ducks, etc. The exceptions are reptiles (because the proportion of body weight comprised by bone in turtles differs significantly from this proportion in snakes) and fishes (in which some minor variability is observed between families or superfamilies). In general, however, the correlation between the skeletal weight and live weight of individuals is very high. The empirically derived formulae used in this analysis are shown in Table 2.[4]

The major problem with using skeletal mass allometry is the fact that the relationship between skeletal weight and live weight can be demonstrated for individuals, but not for portions of individuals. Because few archaeological deposits contain entire individuals, the results are not entirely reliable. An additional source of bias is the differential mineralization and leaching affecting the weight of archaeological bone. Gross differences in bone preservation were apparent in various archaeological deposits in the Lubbub Creek Archaeological Locality. As a result, skeletal mass allometry is used almost exclusively in discussions of the proportions of taxa within a single deposit, since within any single feature leaching or mineralization uniformly affected the bones of each taxonomic class or suborder.

In comparing composite samples, e.g., all fauna from a certain subphase, gross bone weights with no further manipulation were used to assess dietary change. Because no attempt was made to convert these data to figures meaningful in terms of live weight, the calculated percentages are not meaningful in and of themselves. For example, if large mammal bone comprised 75 percent of the total weight of bone from a specific subphase, this does not mean that large mammals actually contributed 75 percent of the meat consumed. The percentages are meaningful only in comparison to percentages calculated for other subsamples of bone. Because it was possible to assign all but eight percent by weight of the total sample of archaeological bone to taxonomic class or suborder, these percentages are a reasonably accurate and reliable indicator of the actual volume of bone present in the total sample and/or subsample -- a characteristic that is not necessarily true of any other quantitative measure. Differential preservation, of course, is a factor which could potentially bias the results of this method, but given the very large sample of bone -- the bulk of which could be attributed to a single taxonomic

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[4] I am indebted to Dr. Elizabeth Reitz (University of Georgia) for supplying these formulae. They are largely based on the osteological collections at the Florida State Museum, Gainesville, Florida, which were made available by Dr. Elizabeth S. Wing.

TABLE 2

Allometric Constants for Biomass Calculations Using Bone Weight.

Taxa	n	Slope (b)	Log -a	Correlation (r^2)
Mammal	97	0.90	1.12	0.94
Bird	307	0.91	1.04	0.97
Turtle	26	0.67	0.51	0.55
Snake	26	1.01	1.17	0.97
Fish	393	0.81	0.90	0.80

grouping (large mammal) -- skewing is probably not significant.

Neither skeletal mass allometry nor bone weight, however, can be used to reliably discern the relative importance of taxonomic families, genera, or species because all taxa are not equally identifiable osteologically. Therefore, minimum numbers of individuals -- albeit with recognized and significant drawbacks as a quantitative technique -- was used to determine the rank order of species as dietary items. Estimates of minimum numbers of individuals (MNI) are traditionally computed on the basis of the most abundant skeletal element for any given taxon. This "minimum" figure may be increased by taking into account the age, sex, and size of the individuals represented (Chaplin 1971). Excluding fish remains, for which MNI was calculated on the basis of size, age (as determined by epiphyseal fusion) was the only additional criterion used in this analysis to determine MNI. In order to convert MNI into figures meaningful in terms of subsistence, MNI per taxon was multiplied by the fraction of the (estimated) average live weight considered edible (White 1953). Whenever possible, the average live weights used in this analysis were derived from data compiled in recent studies on animal populations in or near the study area. These figures could be refined by considerations of the age and sex structure of the archaeological population (e.g., B.D. Smith 1975), but such refinement was justifiable only for white-tailed deer with the present sample.

The reader should be aware that edible meat ratios are extremely crude estimates. It is clear that some species have a higher meat to bone ratio than others due to body morphology. However, these ratios are based on Western views of "edibility" and therefore do not take into account the prehistoric situations in which more than meat, fat, and select internal organs would be consumed.

MNI values are calculated for two aggregations of faunal materials in the following analysis, but only one of these is used as a basis for further inference. As is the custom, MNI is calculated by combining all fauna per time period. In addition, for the Mississippian sample, MNI was calculated per feature based on a subsample of the larger refuse pits and middens. The latter calculations are used to rank the various species as subsistence items and, in my opinion, are reasonably accurate. However, since the present faunal sample is quite large, and the possible aggregation methods numerous, the ranking of species should be viewed critically. The rank of those species that are extremely abundant (e.g., deer) or extremely rare (e.g., Carolina parakeet) in the sample will not change regardless of the combination used in the calculations, but species represented by moderate numbers of skeletal elements are susceptible to rearrangement in response to the method of aggregation (cf. Grayson 1978; 1979).

It should be emphasized that since only the materials larger than one-quarter inch are discussed in this report, some very small species whose skeletal elements are less than one-quarter inch in some dimension may not be represented in the sample although they may have been present in the excavated middens. By the same token, diminutive elements of both medium-sized and small animals, bones of the hands or feet of squirrels or rabbits, for example, generally pass through one-quarter inch hardware cloth (cf. Woodrick 1979). This differential recovery skews the count and weight of the identified bone, thereby overrepresenting the bones of large animals. It is

of particular consequence when percentages of identified bone fragments for taxa of disparate size are compared. The weight of identified bone is not as adversely affected, however, since identifiable elements which pass through one-quarter inch mesh are consistently quite small and correspondingly light.

FACTORS AFFECTING THE COMPOSITION OF FAUNAL ASSEMBLAGES

Unfortunately, the material record often cannot be taken at face value. This is particularly true in archaeobiological studies because numerous cultural, natural, and idiosyncratic factors militate against the preservation and recovery of faunal refuse. Affected are the number and proportions of various taxa and the frequency of specific anatomical parts. The actual survival of prehistoric bone on archaeological sites is the result of a complex series of natural and cultural events and geologic processes which, in combination, provide an environment suitable for preservation. The factors altering faunal assemblages vary to some extent from one archaeological site to another as a result of soil conditions and prehistoric circumstances. Of greatest interest from an anthropological perspective, of course, is the degree to which the faunal assemblage reflects cultural behavior. However, the natural agents of bone attrition cannot be ignored in any zooarchaeological analysis, for these agents partially determine what portion of the faunal record survives. Therefore, both the cultural and natural factors that appear to have modified the sample from the Lubbub Creek Archaeological Locality will be discussed in some detail below.

I. The Natural Agents of Attrition

The natural agents of attrition which can alter the composition of faunal assemblages include carnivore and rodent gnawing, physical weathering, and chemical destruction due to soil acidity. All of these factors differentially destroyed some fraction of the faunal sample from the Lubbub Creek Archaeological Locality.

We know from ethnohistoric accounts and from archaeological remains that dogs were commensals in Mississippian villages. Destruction effected by dogs on bone assemblages usually takes the form of gnawed and partially consumed articular ends of the long bones of large animals (cf. Bonnichsen 1973). Bones of small animals are less likely to escape total consumption, although they are more likely to retain some diagnostic feature if not totally destroyed in the digestive process (Casteel 1971). Since there is no mention of tethering dogs in the ethnohistorical literature, most bone refuse was probably readily accessible to these scavengers.

Fifty-three bones from the present sample exhibited the perforations and jagged edges characteristic of partial destruction by carnivores. Forty-three of the bones, or 80 percent of the bones that survived complete destruction, were identified as deer or large mammal. The remainder of the surviving fragments were rabbit sized or larger. No bone suggestive of partial digestion was observed.

The cumulative effects of dogs scavenging on the bones that survived butchering, consumption, and disposal practices are impossible to quantify at present. It has been suggested by some zooarchaeologists that dogs were the single most important agent of attrition on archaeological sites (Guilday

1971; Smith 1975). However, no means are available to estimate the actual size of the dog population in this village, nor do we know, at present, how or if dog scavenging differentially affects the osteological survival of the various taxonomic classes. Only mammalian and avian bones exhibited evidence of carnivore gnawing in the sample from the Lubbub Creek Archaeological Locality. The actual frequency of bone fragments exhibiting the characteristic perforations was very low -- less than 1 percent of the identifiable fragments -- in both the Mississippian and Late Woodland assemblages. This low frequency could indicate that dog scavenging was not a significant agent of attrition on the present sample, although it is probable that many partially consumed bones either never found their way into the refuse heaps analyzed in this report or were destroyed due to prolonged exposure to other agents of attrition, discussed below.

Seven bones, all from the Mississippian sample, exhibited parallel gouges characteristic of bone partially gnawed by rodents. In most cases, the bones were only slightly affected. The actual impact of rodent destruction on the composition of this faunal assemblage was probably minor.

The bones that escaped the jaws of carnivores must have been buried rapidly in order to have survived. Diurnal and seasonal temperature fluctuations and alternating wetting and drying episodes rapidly destroy the structural integrity of bone, causing it to fracture parallel to the fiber structure and eventually disintegrate (Behrensmeyer 1978:151; Tappen and Peske 1970). Studies of bone weathering in Kenya, near Lake Turkana (formerly Lake Rudolph), indicated that bones of large mammals not covered by sediment were completely destroyed, depending on the microenvironment, within a period of 10 to 20 years. Bones of smaller animals decayed even more rapidly (Behrensmeyer 1978:160), and fish bone survived exposure for only ca. 3 years (Gifford 1977). The observed rates of weathering cited here are probably not as rapid as the rates typical of the much more humid climate in the Southeastern United States. However, it seems clear that differential rates of weathering could modify the composition of faunal assemblages considerably and result in the underrepresentation of the smaller animals.

Under certain depositional circumstances, however, small animals might actually be overrepresented in faunal assemblages. John Yellen (1977) found that the bones of large species were underrepresented by as much as 50 percent in faunal samples recovered from Kalahari Bushmen occupations, since the majority of the bones that were not trodden into the substrate during occupation were consumed by wild animals after the camp was abandoned. The bones remaining on the surface tended to be those of the larger animals. The same phenomenon was observed by Diane Gifford (1978) in her studies of site formation processes in Kenya. Gifford found that the bones likely to be trampled into the substrate in an identifiable condition were those of small animals. The bones of large species were generally broken beyond recognition before the pieces were small enough to migrate subsurface. Those remaining on the surface eventually disintegrated as a result of physical weathering.

Overrepresentation of small animals is unlikely to be a major factor affecting the composition of faunal assemblages at this site. The observations of both Yellen and Gifford stem from the excavation of small, transient camps rather than large, permanent villages. Refuse in these camps was generally left at or near the location of use and thus was subject to

deposition as a result of human traffic. In the Mississippian village at Lubbub Creek, most refuse seems to have been discarded in circumscribed midden areas. These features were probably purposefully covered with sediment to cut down on flies and offensive odors, although periodic alluviation as a result of flooding (cf. Cole, Chapter 2, Volume 1), erosion, or aeolian deposition cannot be ruled out as occasional events potentially contributing to faunal preservation. Given the human propensity for losing or overlooking small items (Schiffer 1978; Gifford 1977), fauna from these features are probably skewed in the opposite manner, as a result of the bones of larger animals being consistently removed from living areas and deposited in refuse heaps.

The only features at this site which seem likely to correspond to the circumstances outlined by Yellen and Gifford are the structures, since small bone fragments probably were overlooked and buried as a result of human traffic. Most of the structures excavated at the site had been disturbed postdepositionally by plowing. Those that showed no overt evidence of disturbance, such as the structures under the mound, were almost devoid of bone, their surface debris presumably having been removed on a regular basis. One Summerville I dwelling, Structure 1 in Hectare 500N/-400E, was largely intact and provided an opportunity to test some of the observations of Yellen and Gifford.

The floor of this structure consisted of a relatively consolidated sandy loam mixed with ash. Two additional 10 cm levels were excavated after the floor was removed. Faunal refuse was recovered from all four quadrants of each level, although the quantity of refuse decreased markedly in each subsequent level. The weight of all bone recovered from each level of the structure is presented in Table 3 by taxonomic class or suborder. Counts of elements identifiable to family, genus, or species from each level of the structure are presented in Table 4.

The observations made by Yellen and Gifford seem applicable to the faunal remains recovered from Structure 1. The percentage by weight of large mammal remains consistently decreased as the depth below the floor increased. All other classes were better represented in the lower levels along with a greater percentage of unidentifiable bone. Surprisingly, however, the percentage by count of identifiable large mammal bone did not decrease significantly in subfloor levels; but the kinds of large mammal elements identified in subfloor levels did differ slightly from those found on the floor of the structure. With a single exception, all were very small -- generally less than 3 cm (1.2 inches) in any dimension. The exception was a nearly complete lumbar vertebra recovered from Level 2. By and large, however, carpals and sesamoids were the most commonly recovered large mammal elements in the subfloor matrix. Most of the deer elements on the structure floor were also quite small, but a large tibia shaft fragment, a proximal scapula, and a proximal femur were recovered from the floor fill (Level 1), the only deer long bones identified from the structure. Identifiable fish remains were recovered with greater frequency in the subfloor levels, including two elements identified as shad/herring (Clupeidae) -- a family with notoriously delicate bone structure (cf. Limp and Reidhead 1979; Parmalee, Paloumpis, and Wilson 1972). Identifiable small mammal, bird, and turtle remains were as common in the first subfloor level as in fill from the structure floor, but were usually unidentifiable in the lowest level.

TABLE 3

strit by Level of Bone Recovered from Structure 1 (Hectare 500N/-400E).

	Level 1		Level 2		Level 3	
	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%
Large Mammal	165.3	74%	66.3	61%	11.30	56%
Small Mammal	7.6	3%	4.2	4%	1.60	8%
Bird	9.0	4%	9.8	9%	0.50	2%
Turtle	7.3	3%	3.1	3%	0.70	3%
Snake	0.4	*	0.2	*	0.10	1%
Amphibian	-	-	-	-	0.01	*
Fish	1.3	1%	1.3	1%	0.55	3%
Unidentified	31.4	14%	23.8	22%	5.40	27%

potential for decay of these parts and could prove to be a means of archaeologically detecting cultural affiliation. Unfortunately, no comparable data are available at present to evaluate this possibility.

THE WOODLAND OCCUPATIONS

Animal bone was preserved in only nine Woodland features, all of which were refuse pits. Seven of the nine features and 97 percent of the bone fragments by weight were attributed to the Middle Miller III period. Less than 50 bones represent the fauna procured during the Miller I/II period, and no bone identifiable to family, genus, or species was recorded from Late Miller III context (see Appendix A). As a result, the following discussion is limited to subsistence and seasonality during the Middle Miller III subphase.

I. Subsistence

Until the present study, most of the subsistence research in west central Alabama has focused on the Late Woodland period. This research suggests that some major alterations in man-land relationships occurred during the Late Woodland period in the Central Tombigbee drainage. There appears to have been an increasing reliance on cultigens during this period with corn gradually replacing other staple carbohydrate sources such as acorns and walnuts (Caddell 1979). Concurrent with this shift in emphasis from wild plant foods to cultigens, greater diversity has been noted in faunal assemblages. This diversification in the resource base is manifested by changes in the frequency of utilization of several animal species or species groups (Curren 1975; Woodrick 1979). Based on faunal material from 1Gr2, Woodrick observed that there "appears to be a decrease in the exploitation of deer throughout the Woodland stage... Concurrently, there is an increase in the numbers of other mammals taken as well as an increase in the percentage of fish in the diet" (1979:137).

The small faunal sample recovered from the Middle Miller III component at the Lubbub Creek Archaeological Locality is quite similar to the much larger Middle Miller III sample analyzed by Woodrick. By weight, the proportions of the various faunal classes in both Middle Miller III assemblages differ considerably from the preceding and subsequent cultural periods, as can be seen in Table 8. According to these data, fish, turtles, and small mammals comprise a much more significant proportion of the diet during Middle Miller III than was the case in any other cultural period.

Curren (1975:243) attributed this apparent diversification of the resource base to the culmination of "primary forest efficiency" (cf. Caldwell 1958). Woodrick (1979) noted that the relative decrease in the exploitation of deer could be due to increased competition for resources with neighboring villages. There is archaeological evidence of population increase during the Woodland period. Late Woodland "base camps" are more numerous, larger, and middens contain denser quantities of debris in each subsequent Woodland period (Jenkins et al: 1975). A growing population and the consequent smaller territories available for extracting subsistence needs would increase the probability of diversifying the resource base. Under stress of food scarcity, diversification has been observed for animal populations (cf. Emlen 1966) as well as hunters and gatherers (cf. Lee 1968).

grease processing and would suggest that this portion of the skeleton, in fact, was usually returned to the village.

No mention has been made of the low frequency of deer scapulae in the preceding discussion. This element probably was not differentially destroyed for purposes of extracting either marrow or bone grease, because it does not contain large quantities of either substance. Since scapulae were probably returned to the village with the remainder of the forelimb, and were boiled like other deer elements, neither field dressing nor cooking methods can explain the low frequency of this element. Instead, the low frequency of the scapula could, indirectly, be a result of agricultural practices. Numerous ethnohistoric sources attest to the use of deer and bison scapulae as "hoes" (Hudson 1976:297). If this element was selected for its utility as a horticultural implement, the relative frequency of scapulae in refuse deposits could prove useful in monitoring, on a regional basis, the relative intensity of agricultural pursuits.

The disposal of bone refuse is the final cultural practice that deserves mention. Besides the scavenging and destruction of bone refuse by village dogs, bone was destroyed or discarded intentionally, usually by either incineration or burial.

In some cases, culturally prescribed rules of refuse disposal probably have affected the results of nearly all faunal analyses in Eastern North America. Disposal of the postcranial remains of black bear, for example, appears to have been governed in large part by the following taboo: "Should a dog gnaw or even touch them [the bones], the 'spirit' or 'owner' of the animals will be offended and misfortune or poor luck in hunting will result" (Hallowell 1926:136). Bruce Smith (1975:118-119), in discussing the paucity of bear bones in faunal samples from seven Mississippian sites in the Mississippi Valley, noted that bear remains may have been "discarded in places they could not be found by dogs (or archaeologists)" as a result of this belief. It is interesting to note here that a nearly complete bear scapula was found by the author in clay deposits at the river's edge north of the site. However, within the excavated village refuse deposits, only nine postcranial bones identified as bear were recovered. This taboo seems to have been ignored after colonization, for large numbers of bear bones are found in faunal refuse from Indian villages dating to the seventeenth century (cf. Guilday et al. 1962; Guilday 1971). Although this radical shift in the composition of archaeofaunas could be interpreted as a change in subsistence (perhaps as a result of the introduction of firearms), it is also possible that the observed pattern resulted from erosion of the belief in this taboo.

Much of the bone recovered from the Lubbub Creek Archaeological Locality was burned, a practice probably more closely related to refuse disposal than to cooking methods. This conclusion is suggested by the patterning observed in the burning of specific deer elements (Table 7). Between 50 and 86 percent of all identified bone fragments from the lower legs (carpals, tarsals, metapodials, phalanges) were charred or calcined, the only exception being the metacarpus. In contrast, other than the scapula, bones of the upper limbs including the pelvis exhibited evidence of burning much less frequently (16 to 28 percent of the identified fragments). Without exception, the parts that were burned most frequently are those of little economic value. This patterning may represent a culturally prescribed means of reducing the

If I am correct in arguing that nearly all deer elements were subjected to boiling, the remaining alternative to field dressing as an explanation for the underrepresentation of the axial skeleton is differential destruction of ribs and vertebrae for purposes of consumption. Two kinds of fatty tissue are contained in skeletal elements: marrow and bone grease. Bone marrow is located almost exclusively in the shafts of long bones. Bone grease is embedded in the trabeculae of the cancellous bone located at the articular ends of certain long bones and in vertebrae. Extraction of bone marrow does not entail extensive destruction of bone. A single fracture at midshaft allows access to the marrow cavity. In processing bones for the extraction of bone grease, however, the selected skeletal elements are usually fractured extensively and in some cases may be pulverized beyond recognition.

Although processing bone for the extraction of bone grease is not specifically alluded to by ethnohistoric sources on Southeastern Indians, deer "suet" was reportedly used as butter (Hariot in Swanton 1946:362). The Nunamiut Eskimo distinguish two kinds of bone grease: white and yellow. Yellow grease is obtained from parts of the axial skeleton and white grease from the cancellous tissue in the articular ends of long bones. White grease contains a higher percentage of oleic acid (a fatty acid with a low melting point) and is considered more desirable for consumption by the Nunamiut (Binford 1978:32-34). According to ethnohistoric sources cited by Vehik (1977:171), grease obtained from the long bones remains a liquid, presumably due to the higher content of oleic acid, while that from the axial skeleton eventually hardens. The use of the term "suet", mentioned above, suggests that vertebrae were included in bone grease manufacturing in the Southeast, possibly accounting for their low representation at this site. Bone grease processing may also account for the slight to moderate underrepresentation of proximal humeri, proximal and distal femora, and proximal tibae in the Mississippian sample. These portions of all of these elements are considered desirable candidates for bone grease processing by the Nunamiut (Binford 1978:164).

At this juncture, it is impossible to determine the extent to which the underrepresentation of the axial skeleton can be attributed to either bone grease processing or field dressing, but some combination of the two cultural practices is clearly responsible for the observed pattern. Some field dressing undoubtedly did occur prehistorically. Schoeniger and Peebles (1980) noted that males in the burial population at the Moundville site apparently had consumed more meat on the average than females, which they attributed to the opportunities presented during field butchering. Based on this sample of faunal remains, it is probable that ribs were consumed in the field. They are rare in this assemblage and probably would not have been processed for bone grease. The extent to which the vertebral column was culled in the field is more problematical. There were numerous unidentifiable large mammal bone fragments in the Mississippian assemblage which were not the fragments of long bone shafts. Many of these bone fragments may have been the unrecognizable remains of vertebrae and the articular ends of long bones which had been processed for bone grease. By weight, these unidentifiable large mammal fragments comprised 7.6 percent of the bone identified as deer, bear, or large mammal. Although this percentage is undoubtedly affected to some extent by the conditions of bone preservation at the site, it might nonetheless be useful in a general way for future comparisons. Relatively large quantities of such unidentifiable fragments could be indicative of frequent on-site bone

TABLE 6

Fragmentation of Deer Elements Recovered from Mississippian Features[1].

	<1/4	%	1/4	%	1/2	%	3/4	%	Com-plete	%	Total Fragments
Maxilla	1	13%	1	13%	3	38%	2	25%	1	13%	8
Mandible	2	18%	2	18%	[illegible]	18%	3	27%	2	18%	11
Atlas	2	40%	1	20%	0	-	0	-	2	40%	5
Axis	1	100%	0	-	0	-	0	-	0	-	1
Cervical V.	13	100%	0	-	0	-	0	-	0	-	13
Thoracic V.	6	32%	6	32%	4	21%	0	-	3	16%	19
Lumbar V.	35	71%	2	4%	0	-	2	4%	10	20%	49
Pelvis	6	43%	2	14%	5	36%	1	7%	0	-	14
Ribs[2]	202	71%	72	25%	9	3%	0	-	0	-	283
Sternebrae	0	-	0	-	0	-	0	-	3	100%	3
Scapula	7	70%	0	-	1	10%	2	20%	0	-	10
Humerus	16	37%	18	42%	6	14%	3	7%	0	-	43
Radius	21	41%	16	31%	9	18%	3	6%	2	4%	51
Carpals	0	-	4	6%	10	16%	7	11%	42	67%	63
Metacarpus	10	77%	2	15%	1	8%	0	-	0	-	13
Femur	31	62%	14	28%	3	6%	2	4%	0	-	50
Tibia	26	46%	16	29%	10	18%	4	7%	0	-	56
Tarsals	1	3%	4	11%	4	11%	3	9%	23	66%	35
Astragalus	2	14%	1	7%	2	14%	3	21%	6	43%	14
Calcaneus	7	29%	6	25%	2	8%	3	13%	6	25%	24
Metatarsus	39	71%	7	13%	6	11%	3	5%	0	-	55
Phalanx 1	30	41%	26	36%	5	7%	3	4%	9	12%	73
Phalanx 2	12	26%	23	49%	4	9%	1	2%	7	15%	47
Phalanx 3	3	11%	9	33%	2	7%	3	11%	10	37%	27

[1]Includes only elements which exhibited predepositional breakage.
[2]Includes fragments identified as large mammal.

muscle tissue from these skeletal elements due to abundant connective tissue (ribs) and irregular surface areas (vertebrae). However, there is archaeological evidence indicating that muscle tissue was at least occasionally removed from the upper limb bones.

This evidence for "filleting" meat is manifested directly on archaeological bone. A series of short scores transverse to the long axis of the bone was observed on all surfaces of the humerus (5 cases) and on the anterior and posterior surfaces of the femur (2 cases). In all instances, these scores were present in areas on the diaphysis for which no other purpose (such as disarticulation) could have been intended. Meat may also have been removed from scapulae and other long bones under certain circumstances. Light scoring was present on the posterior border of one scapula near the origin of Teres minor and the Deltoideus, as well as a branch of Triceps brachii, all of which insert on the humerus. Possible stripping marks were observed on the anterior surface of a single radius near the insertion of the Extensor carpi radialus, one of the muscles detached by the cuts (discussed previously) that were observed on the lateral surface of the distal humerus. Unlike the marks observed on other long bones, the striations on this radius ran parallel to the long axis of the bone. The meat that was removed from these bones may have been added to soups or stews immediately or dried for later consumption (processing meat for storage will be discussed in the Mississippian section of this chapter).

The question that remains is whether or not the long bones were boiled after the meat was removed. The archaeological evidence discussed up to this point suggests that only the vertebrae and ribs were boiled and therefore potentially subject to differential destruction. However, although meat appears to have been removed from the limbs, the long bones were probably boiled after extraction of the bone marrow. Only two complete long bones were recovered from Mississippian features, a radius of an adult deer in the mound fill and a radius of a fawn in Pit 14 (Hectare 500N/-400E). Most of the identified long bones (and nearly all unidentified large mammal long bones) were only one-quarter or less of their original size (Table 6). Since bone marrow can be extracted without this degree of fragmentation, much of the observed breakage can probably be attributed to the necessity of reducing the bones to a size small enough to fit into the average Mississippian cooking vessel.

The interpretation that the extensive fragmentation characteristic of these long bones is related to cooking methods is based on John Yellen's (1977:302) observation that the size of long bone fragments at !Kung encampments appeared to be directly related to the size of the available cooking vessel. Yellen (ibid) noted, for example, that the "femur [was] represented by significantly more fragments than any of the other long bones" at !Kung sites. Relatively extensive destruction of this element for purposes of boiling the bone was necessary because the femur of artiodactyls is larger than the other long bones. In this assemblage, 90 percent of the identified femur fragments represented one-quarter or less of the entire bone. In contrast, this degree of reduction was true for only 71 to 79 percent of the humerus, radius, and tibia fragments in the assemblage (cf. Table 6). This differential destruction, in fact, is probably partially responsible for the underrepresentation of the femur in the assemblage, because small fragments are more difficult to identify osteologically.

hardship involved. Although this figure might be expected to vary depending on the need for food and the distance to be travelled, it is notable that the average deer in this sample weighed 50 kg (110 lbs), suggesting that at least two men would have been necessary for overland transport of the entire animal. If the upper load limit per person for the !Kung is taken as an average for Southeastern Indians, ca. 18 kg or 36 percent by weight of the average deer would, of necessity, have been culled or consumed in the field by a solitary hunter without recourse to additional labor in transferring the carcass to the village. It seems clear given the frequencies of identified deer elements in Figure 1 that the skull (probably not including the tongue), neck, thoracic vertebrae, ribs, and lumbar vertebrae are the parts that probably were not consistently returned to the village. The sum of the weight of these parts with the addition of the lungs, windpipe, and viscera comprise 32.4 percent of the weight of a caribou (Binford 1978:16-17). This figure closely approximates the 36 percent of the deer that would necessarily have been left behind.

An alternative explanation for the underrepresentation of the axial skeleton (and some other elements) is that the bones making up these anatomical units were differentially destroyed during preparation for consumption. This could have occurred as a result of either intentional bone fragmentation for purposes of gaining access to the fatty tissues (marrow or bone grease depending on the element and element portion) contained within the bone or unintentionally as a result of differential exposure to heat.

Heat partially destroys the organic component (collagen) of bone, which reduces structural integrity (Gifford 1977:229) and increases the probability of both pre- and postdepositional fracture (Blavin 1979). Therefore, if vertebrae and ribs were subjected to intense heat during preparation for consumption (such as would occur if the bones were boiled) but other skeletal elements were not, some differential destruction of ribs and vertebrae may have occurred.

Southeastern Indians reportedly used three methods for cooking meat, only one of which leaves directly visible traces on the bone. Meat was broiled over an open flame, roasted (wrapped in some material and buried in either ashes or a roasting pit), and boiled (Swanton 1946:368-372). Only one deer bone, a radius from Pit 4 in Hectare 500N/-400E, was charred in a fashion suggestive of broiling. Both the proximal and distal ends of this bone were scorched in areas not covered by a thick layer of muscle tissue. Since this pattern was observed on only a single element, broiling meat with the bone attached was probably not the customary means of cooking the meat from the limbs. To my knowledge, there are no Mississippian features in the Lubbub Creek Archaeological Locality which have been interpreted by the excavators as "roasting pits." This negative (albeit tentative) evidence suggests that roasting was not a popular cooking technique. The final possibility is boiling, which, according to early European colonists, was quite commonly used. Lawson, for example, commented that Southeastern Indians ate an "abundance of broth" (in Swanton 1946:369).

Although by default it can be concluded that boiling was probably the predominant means of cooking venison, this does not necessarily indicate that all skeletal elements were included in the stew pot. It is reasonable to suspect that ribs and vertebrae were boiled, for it is difficult to remove the

Determining the customary butchering patterns for the axial skeleton is more difficult due to the fragmentary nature of the remains and the paucity of butchering marks. Some generalizations are possible, however, based on the few butchering marks observed, patterning in the association of elements, and patterning in bone fragmentation.

Butchering marks were observed on the occipital condyles of one basioccipital indicating removal of the skull from the vertebral column by cutting between the skull and the atlas. Although no butchering marks were observed, the ascending ramus of 7 out of 9 relatively complete mandibles had been broken off, presumably to remove the mandible with the attached tongue.

The vertebral column appears to have been subdivided into units of 2 to 4 vertebrae. Scoring was noted on the anterior zygopophysis of a fifth cervical vertebrae, just posterior to the articular facet for the fourth cervical. Although no other butchering marks were evident on other vertebrae, it is notable that three articulated thoracic vertebrae were recovered <u>in situ</u> from Pit 4 (Hectare 500N/-400E), and two segments of articulating lumbar vertebrae, a series of three vertebrae from an immature individual, and two from a large mature individual, were found in Pit 14 (Hectare 500N/-400E). Since these vertebral segments would have measured 10 to 15 cm (4 to 6 inches) in length -- a size that would easily fit into the average Mississippian cooking vessel -- this evidence suggests that short segments of the vertebral column were boiled after removal of the ribs.

There is no direct evidence of the method used to remove the ribs from the vertebral column. However, since nearly all (90 percent) of the proximal rib fragments were only one-quarter or less of their original size, the rib cage was probably broken off as a unit just below the articulation of the ribs with the thoracic vertebrae. Separating the ribs in this manner would have been practical only after removal of the tenderloin and the brisket (sternum and costal cartilage) had allowed some leverage in removing the ribs as a unit. These rib slabs may have been roasted. However, most rib fragments, including shafts and distal ends, were broken so extensively, it is probable that they too were boiled.

Of the six major anatomical units defined with this assemblage, two may have been left behind at the kill site -- the skull and the remainder of the axial skeleton, vertebral column, ribs, and sternum. Both the front and hind limbs were undoubtedly returned to the village in most cases. Although the femur is grossly underrepresented, both the pelvis (actually the acetabulum) and the distal tibia are well represented. The high frequency of both the distal humerus and the proximal radius suggests the forelimb was customarily carried back. These parts probably were returned with the metapodials and feet still attached (cf. Figure 1). In contrast, parts of the axial skeleton -- skull, mandible, atlas, axis, cervical, thoracic and lumbar vertebrae, ribs, and sternebrae -- are consistently underrepresented to varying degrees in the archaeological assemblage.

Transportation was undoubtedly a problem for Southeastern Indians when only one or two hunters procured a deer at some distance from the village, unless the animal was killed near a watercourse and a canoe was available for transporting the carcass. Yellen (1977:284) reports that the !Kung rarely carry loads of meat greater than 27-32 kg (60-70 lbs) because of the physical

divided into at least two parts.[5] Butchering marks were observed at the "elbow" joint. Gouges were present on the medial condyles of two distal humeri. Additional scoring was observed on the humerus shaft just proximal to the distal condyles. In two cases, distal humeri exhibited scoring transverse to the long axis of the bone near the origin of the Extensor carpi radialis. These scores may have been for the purpose of cutting the muscle(s) in order to detach the radius, or may have been made while stripping the muscle from the bone. The same is true of the marks observed on the medial surface of distal humeri. The scoring was analogous to that observed on the lateral surface and was located in the vicinity of the origin of the Flexor carpi ulnaris, a branch of the Flexor carpi radialis, and the attachment of a ligament (Lig. collaterale ulnare). Both muscles insert on the radius; the ligament binds the humerus to the ulna. Marks were observed on one proximal ulna at the attachment of the lateral radio-ulnar ligament.

A second possible method of subdividing the forelimb was observed in the faunal sample recovered from Pit 14 (Hectare 500N/-400E). The right distal humerus, proximal radius, and proximal ulna of an unusually large deer were recovered from Pit 14, none of which exhibited any butchering marks. However, the distal humerus had been broken about 10 cm above the distal condyles, and the proximal radius and ulna were broken about 6 cm below the elbow joint. Since all of these articulating elements were recovered from a single cut of Pit 14, they may represent an alternative, expedient means of dividing up the front limb. In order for the bone to have been broken at these locations, the overlying muscle tissue must first have been removed.

The rear limb appears to have been detached from the body by removing enough muscle tissue in the hip region to expose the pelvis, after which a chopping blow was delivered to the innominate above and below the acetabulum. No scoring was noted in or near the acetabulum, nor on the head of the femur, suggesting that the femur and acetabulum were removed as a unit. This butchering method probably proved more expedient than would an attempt to cut the numerous ligaments attaching the femur to the pelvis. It should be noted that portions of the pelvis were partially destroyed in the process. In addition, the sacrum may have been extensively damaged.

The rear limb was subsequently divided into at least three parts. One distal femur exhibited butchering marks on the medial condyle. These marks were probably the result of cutting the medial patellar ligament in separating the tibia from the femur. Disarticulation of the hock joint, comparable in difficulty to disarticulation of the elbow, resulted in numerous scores on the distal tibia, the astragalus, and the calcaneum. Butchering marks observed on the medial, anterior (dorsal), and lateral surfaces of a distal tibia, just proximal to the attachments of the numerous ligaments binding the hock to the tibia, may represent a failed attempt to detach the tibia, or may be marks left in the process of skinning the carcass. All other butchering marks in this region were noted on the distal condyles of the astragalus and near the proximal end of the calcaneus, distal to the tuber calcis (5 cases).

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[5]Although butchering marks were not observed at all locations, it is probable that the forelimb was divided into at least four parts: the scapula, humerus, radius, and the lower limb.

articulated anatomical parts, patterning in bone breakage, and patterning in the location of charring on specific elements.

Butchering marks were extremely uncommon in the faunal sample recovered from the Lubbub Creek Archaeological Locality. This is undoubtedly due, in part, to the poor preservation of bone in many features. Often, the cortex of long bones was marred by insect burrows and root casts, and the bone was so badly leached it was easily scored by shovels and trowels. As a result, scored bones were closely scrutinized to rule out the possibility of postdepositional modification. Three classes of butchering marks were recognized: marks resulting from skinning the animal; scores produced in the disarticulation of one bone from another; and nicks along the shafts of various long bones that were probably made while stripping the muscle and connective tissue from the bone.

Two probable skinning marks were noted in the Mississippian faunal assemblage. One deer mandible exhibited scoring along the medial and lateral edge of the diastema, possibly a result of detaching the pelt at the chin. A deep score was also present on the lateral surface of a third phalanx, just below the articulation for the second phalanx, suggesting that the skin was cut just above the hoof. This contrasts with the observations of Guilday, Parmalee, and Tanner (1962) that an effort was made, in butchering the deer recovered from the Eschelman site, to avoid the difficult task of skinning the feet by cutting the skin above or at the articulation of the metapodials with the phalanges. Woodrick (1979) found skinning marks on metapodial shaft fragments from the Gainesville Lake, but she was unable to detect the actual location of the cuts due to the fragmentary nature of the scored bones. The other skinning location frequently cited in the zooarchaeological literature is the skull, with marks occurring just above the maxillary tooth row (Smith 1973) and encircling the base of antlers still attached to the frontals in bucks (Guilday et al. 1962; Guilday 1971; Parmalee 1965). Neither of these locations was scored in the present sample, although this is probably due to the general paucity of well preserved skull fragments at the site.

In order to evaluate the possibility that field dressing was responsible for the low representation of specific parts, it is necessary to define major (or primary) anatomical butchering units. The definition of these units is essential because it is improbable that most carcasses were completely disarticulated prior to transfer. Therefore, if field dressing occurred, whole sections rather than individual bones of the animal should be underrepresented. Based on this archaeological assemblage and knowledge of Cervid anatomy (Binford 1978; Spiess 1979), six major anatomical units appear probable: the head; the vertebral column with attached ribs, sacrum, and iliac blades; the two forelimbs (phalanges to scapula); and two hindlimbs (phalanges to acetabulum). Each of these anatomical units was subsequently subdivided for distribution and consumption. The archaeological evidence for these assertions is discussed below.

The front limb appears to have been removed from the body by cutting between the scapula and the ribs. Long striations which originated at the distal end and were parallel to the long axis were observed on the medial side of one scapula blade. Much of the muscle tissue covering the chest could have been removed with the scapula (refer to Spiess 1979:290 for a detailed description of the musculature involved). The front limb was subsequently

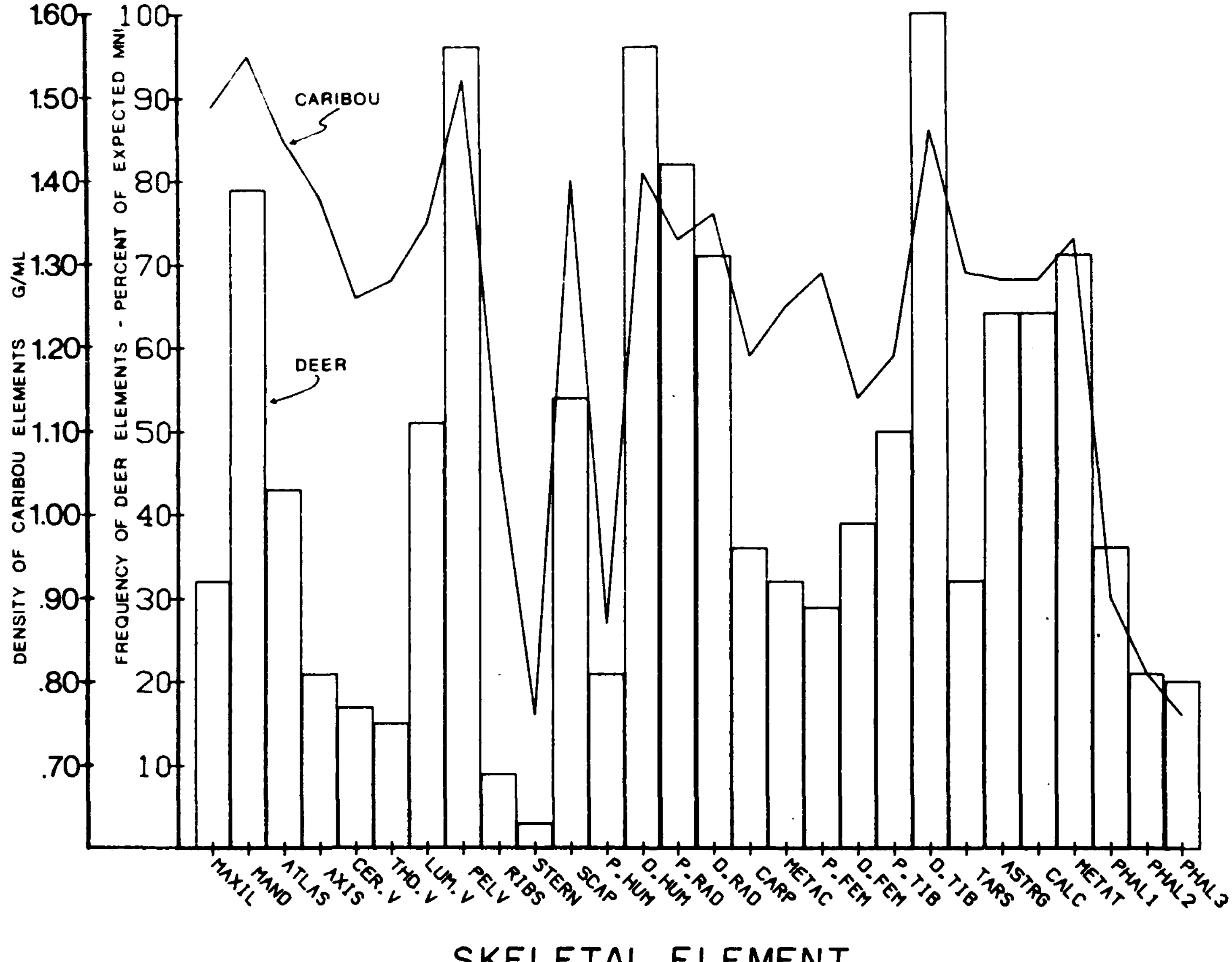

Figure 1. Comparison of the frequency of white-tailed deer elements in the Mississippian sample to the density of analogous elements in caribou.

TABLE 5

Frequency of Deer Elements Recovered from Mississippian Sample.

	Observed	Expected	% of Expected
Maxilla	9	28	32%
Mandible	22	28	79%
Atlas	6	14	43%
Axis	3	14	21%
Cervical vert.	12	70	17%
Thoracic vert.	26	168	15%
Lumbar vert.	36	70	51%
Pelvis	27	28	96%
Ribs	31	336	9%
Sternebra	3	98	3%
Scapula	15	28	54%
Prox. humerus	6	28	21%
Dist. humerus	27	28	96%
Prox. radius	23	28	82%
Dist. radius	20	28	71%
Carpals	61	168	36%
Prox. metacarpal	9	28	32%
Prox. femur	8	28	29%
Dist. femur	11	28	39%
Prox. tibia	14	28	50%
Dist. tibia	28	28	100%
Tarsals	27	84	32%
Astragalus	18	28	64%
Calcaneus	18	28	64%
Prox. metatarsal	20	28	71%
Phalanx 1	40	112	36%
Phalanx 2	23	112	21%
Phalanx 3	22	112	20%

[1]Expected frequencies were calculated by multiplying each element by the number expected in 14 complete individuals, using the frequency of the most commonly encountered element (distal tibia) as a baseline. Symmetry was not considered.

effects of cultural practices on the final configuration of skeletal elements.

Faunal samples rarely contain all of the elements of white-tailed deer in the appropriate or expected frequencies, and the sample from the Lubbub Creek Archaeological Locality is no exception. As can be seen in Table 5, most deer elements occur in frequencies much lower than would be expected if each individual were completely preserved. In part, this skewing can be attributed to the preservational bias introduced as a result of bone density. Some skeletal elements are extremely dense and, as a result, can better endure the attrition caused by both natural and cultural agents.

At present, to my knowledge no attempt has been made to quantify the absolute density of deer elements, although density has long been accused of skewing the frequency of deer remains recovered archaeologically (cf. Guilday 1971). In the absence of data on white-tailed deer, data compiled for caribou (Binford and Bertram 1977) will be used to tentatively assess destruction of bone in excess of that expected as a result of natural factors. Although the absolute density of caribou bone is not directly comparable to white-tail deer, the relative density of the various elements can provide a reliable baseline, since the two species are quite similar anatomically and closely related taxonomically (both are members of the family Cervidae).

The relationship between bone density and the survival of specific deer elements in the Mississippian sample from the Lubbub Creek Archaeological Locality is shown graphically in Figure 1. Clearly, the relative density of specific elements explains a large portion of the deviation between observed and expected frequencies. Although it is not possible to quantitatively assess the differential destruction, it seems clear that much of the axial skeleton (skull, vertebrae, and ribs) is grossly underrepresented in the archaeological assemblage, as are the scapula, femur, tarsals, and carpals. Most of these deviations from the expected are probably due to cultural practices (butchering, field dressing, and customary cooking methods), but the low frequencies of the small but durable tarsals and carpals may have resulted from differential recovery.

Determining precisely which cultural practice is responsible for the low frequencies of some parts is complex and not always possible. Each deer carcass was subjected to numerous stages of decision-making prior to entering the archaeological record. Some butchering and culling of parts may have occurred at the kill site if transportation proved difficult due to extremes of either distance or carcass weight. Field dressing, therefore, could be responsible for the low frequency of some parts. The parts returned to the village would have been subdivided for distribution to relations and possibly to political superiors, and eventually subjected to a third round of butchering in preparation for cooking and consumption. It is these latter stages of butchering that determine the final form (and the recognizability) of an archaeological faunal assemblage (cf. Yellen 1977:327). The degree to which an element is broken can affect both archaeological recovery and identifiability of bone refuse, and most bone breakage occurs for purposes of cooking and consumption.

There are several means of determining prehistoric butchering, cooking, and consumption practices using archaeological remains: striations left on the bone during skinning and disarticulation of the animal, spatial association of

As mentioned previously, faunal remains from all other excavated structures were either recovered in very small quantities or came from structures which exhibited post-depositional disturbance. For this reason, bones of larger animals are probably more frequent in the composite faunal sample than would be expected under a different set of depositional circumstances.

The paucity of bone in most structures on the site could be due to refuse disposal patterns, as mentioned previously. Alternatively, the lack of bone could be attributed to soil acids. The pH of surface soils in the Lubbub Creek Archaeological Locality varied from 4.8 to 5.6 in the excavated areas, excluding one small area with a pH of 8.0 in the vicinity of the mound. Calcium phosphate in bone becomes soluble and is susceptible to leaching in faintly acid solutions with a pH of 6.8 (Beik 1963). Almost invariably, well preserved bone came from features or areas of the site with high densities of mussel shell. Shells are also subject to leaching in acidic soils, but the calcium leached from decomposing shell increases the pH of the postdepositional environment, contributing to bone preservation. Although nearly all other agents of attrition and depositional processes acted in consort to discriminate against the preservation of the bones of smaller animals in the Lubbub Creek Archaeological Locality, to some extent the reverse may have been true of soil acidity. There is reason to suspect that the prehistoric exploitation of shellfish was an activity in large part restricted to the warmer months (Woodrick, Chapter 5, this volume; and below). As such, those species exploited concurrently or penecontemporaneously with the collection of shellfish might be overrepresented in the composite faunal sample if refuse locales were used on a short-term basis rather than for extended periods of time. Since according to archaeological research (e.g., Smith 1975; below) and ethnohistoric sources (e.g., Swanton 1946) deer and bear were usually hunted during fall and winter, large mammal remains could be underrepresented if discard occurred in areas without some mussel shell in association. This possibility is probably not of great significance in the interpretation of Mississippian subsistence, since many refuse areas seem to have been utilized for relatively extended periods of time, but the effects on the Late Woodland sample are potentially considerable, as will be discussed below.

II. Cultural Factors Affecting the Composition Faunal Assemblages

Zooarchaeologists have only recently begun to understand the prehistoric decision-making and cultural practices which are reflected in faunal remains. Some fraction of each archaeological faunal assemblage was partially or completely destroyed, rendered more susceptible to natural agents of attrition, or purposefully deleted from the archaeological record prehistorically as a result of customary butchering, field dressing, cooking, consumption, and disposal practices.

Recent ethnoarchaeological research focusing on the treatment of large mammals by the !Kung Bushmen and the Nunamiut Eskimo suggests that some cultural practices are potentially of value in ascertaining cultural affiliation, subsistence security, and site function (cf. Yellen 1977; Binford 1978). Of the two large mammals (bear and deer) recovered from Mississippian deposits at the Lubbub Creek Archaeological Locality, only deer bones were recovered in sufficient numbers to warrant a detailed consideration of the

TABLE 4

Distribution by Level of Bone Identifiable to Family, Genus, or Species in Structure 1 (Hectare 500N/-400E).

	Level 1		Level 2		Level 3	
	Pieces	%	Pieces	%	Pieces	%
Large Mammal	15	43%	11	37%	5	38%
Small Mammal	6	17%	5	17%	1	8%
Bird	3	9%	2	6%	1	8%
Turtle	5	14%	4	13%	0	-
Snake	3	9%	1	3%	1	8%
Amphibian	-	-	-	-	1	8%
Fish	3	9%	7	23%	4	31%
IDENTIFIED PIECES/ TOTAL PIECES	35/474	(7.4%)	30/280	(10.7%)	13/110	(11.8%)

TABLE 7

Counts and Percentages of Burned Versus Unburned Deer Elements from Mississippian Deposits

Element	Unburned		Calcined		Charred		Total
	Ct.[1]	%	Ct.[1]	%	Ct.[1]	%	
Maxilla	8	100%	0	-	0	-	8
Mandible	10	91%	0	-	1	9%	11
Atlas	3	60%	0	-	2	40%	5
Axis	0	-	1	100%	0	-	1
Cervical Vert.	1	8%	7	54%	5	38%	13
Thoracic Vert.	15	79%	3	16%	1	5%	19
Lumbar Vert	23	47%	11	22%	15	31%	49
Pelvis	11	79%	1	7%	2	14%	14
Ribs[2]	130	46%	98	35%	55	19%	283
Sternebrae	2	67%	0	-	1	33%	3
Scapula	5	50%	1	10%	4	40%	10
Humerus	32	74%	5	12%	6	14%	43
Radius	41	80%	4	8%	6	12%	51
Carpals	15	24%	38	60%	10	16%	63
Metacarpus	9	69%	2	15%	2	15%	13
Femur	36	72%	4	8%	10	20%	50
Tibia	47	84%	2	4%	7	13%	56
Tarsals	15	43	13	37	7	20	35
Astragalus	6	43%	3	21%	5	36%	14
Calcaneus	12	50%	6	25%	6	25%	24
Metatarsus	26	47%	19	35%	10	18%	55
Phalanx 1	10	14%	50	68%	13	18%	73
Phalanx 2	9	19%	26	55%	12	26%	47
Phalanx 3	6	22%	10	37%	11	41%	27

[1]Includes only elements which exhibited predepositional breakage.
[2]Includes fragments identified as large mammal.

TABLE 8

Comparison by Weight of Faunal Utilization through time in the Tombigbee Valley during Miller III.

	Early Middle III	Middle Miller III		Late Miller III
	Gainesville	Gainesville	Lubbub	Gainesville
Large Mammal	88.0%	70.9%	66.2%	76.5%
Small Mammal	2.6%	4.7%	7.3%	5.3%
Bird	1.8%	4.2%	4.8%	9.0%
Turtle	6.6%	16.1%	14.5%	7.2%
Fish	0.9%	4.1%	7.3%	2.1%
Sample Size	3026.8g	1991.9g	373.2g	3666.8g

One factor that has consistently been ignored in previous studies is the possibility that these Late Woodland and more specifically Middle Miller III settlements were not occupied year-round. Implicit in the arguments cited above is the assumption that the yearly economic cycle is fully represented. The Middle Miller III faunal sample recovered from the Lubbub Creek Archaeological Locality suggests, at least tentatively, that such an assumption may be unwarranted. The evidence for seasonal rather than year-round occupation will be discussed in some detail below.

II. Seasonality

Unlike plant foods which ripen during a restricted period of time and thus must either be harvested immediately or go unutilized, most animals can be exploited throughout the year given the appropriate technology. Early European explorers and colonists reported the season of exploitation for several of the major animal resources in the Southeast including deer, bear, and fish (Swanton 1946). In addition, attempts have been made to determine the probable season or seasons of exploitation for other animal species on the basis of behavioral studies and ecology (Smith 1975) and on the basis of the projected nutritional needs of prehistoric human populations and the labor required for harvest (Keene 1979; Reidhead 1976). However, scant archaeological data have been available for testing these models, and the timing of the exploitation of many minor animal resources is still not well understood.

The faunal assemblage from the Middle Miller III occupation at Lubbub Creek is too small to provide a representative sample of the full range of exploited species. The context of the bone, however, does provide a basis for interpreting the scheduling of animal resource utilization during certain seasons and thus may aid future attempts to discern the seasonality of other Late Woodland and possibly Mississippian settlements in the Tombigbee Valley.

Crucial to the following interpretation is the depositional context of the bone. Five of the seven Middle Miller III pits were stratified refuse pits which clearly indicated multiple acts of refuse discard. The major assumption in the following interpretation is that the fauna in these strata are representative of the refuse produced by subsistence activities between discard episodes.

These Late Woodland features were recovered from two discrete areas. One pit was recovered from Hectare 400N/-500E in an area isolated from any plowzone scatter of Late Woodland ceramics. All of the remaining Woodland features were recovered from a single 10 x 10 m unit in Hectare 300N/-300E which, based on the distribution of plowzone ceramics, is located on the northeastern edge of a Woodland settlement which covered an area slightly less than a hectare in extent. The size and shape of the pits and the seasons represented by the fauna were different in the two areas and thus will be discussed separately.

Hectare 300N/-300E

Pit fill from four of the six Middle Miller III pits recovered from this hectare was stratified. Two of the stratified features, Pit 20 and Pit 33, had a largely sterile zone separating an upper and a lower stratum -- each of

which contained bone, shell, ceramics, and lithics. In the case of Pit 33, the sterile stratum was a thin, discontinuous band of sand that may have resulted from the slumping of the wall of the feature or may have been placed there purposefully to bury a dense concentration of fresh mussel shell. The faunal samples recovered from these two pits were small and, as a result, less reliable than the samples recovered from the two remaining stratified features, Pit 22 and Pit 32. No sterile strata were encountered in the latter features, and each of the zones yielded a reasonably large sample of bone. As a result, the following analysis relies heavily on Pit 22 and Pit 32. The profile of Pit 32 is shown in Figure 2.

The count and weight of bone identifiable to class from each zone of these features is shown in Table 9. Because half of each feature was excavated as a unit, only one-half of the faunal sample could be assigned to strata. However, this sample proved sufficient, for all of the stratified features show a tendency for fish bone (by count and by weight) to decrease as the pits were filled, while the abundance of both large and small mammals increases as the pits were filled. The probable contribution to the diet of each class is shown graphically in Figure 3 for the two larger samples (Pit 22 and Pit 32). Meat contribution was calculated using skeletal mass allometry and was corrected in a very gross way for usable meat.[6]

The changes in frequency of the various classes strongly suggest that these pits were filled during the summer and early to mid-fall. According to Swanton, at the time of European contact, "Summer was first and foremost the time for raising corn and other vegetables, and second the great fishing season..." (1946:259). Annulus formation on fish vertebrae suggests that fishing was a summer activity 800 years earlier as well. A total of 27 vertebrae from fishes under three years of age could reliably be assigned season of death based on criteria outlined in Casteel (1976) in conjunction with comparison to specimens for which the date and locality of procurement was known. All of the vertebrae exhibited some growth beyond a recently formed annulus, suggesting summer as the probable season of death. These vertebrae were recovered from all zones which yielded fish in Pit 22 and all but Zone D of Pit 32 (which produced only one fish skull fragment).

In addition to the fish vertebrae, a single bone from a migratory bird, a black tern (Chlidonias nigra), was recovered from Zone B of Pit 22. In Alabama,

> This species arrives from the south in April or early in May, but at that season it is not very common. In the fall migration it arrives from the north early in July and is extremely abundant locally during August and September (Howell 1928:33).

The presence of this species supports the interpretation that these pits represent a summer occupation, but also suggests, on the basis of abundance and therefore probability of procurement, that fauna in this stratum were exploited late in the summer -- probably in August or September. This seasonal assignment is considered even more likely given the presence of two

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[6]The multiplication factor for mammals was .6; for birds, .7; for turtles, .35; and for snakes, amphibians and fish, .8.

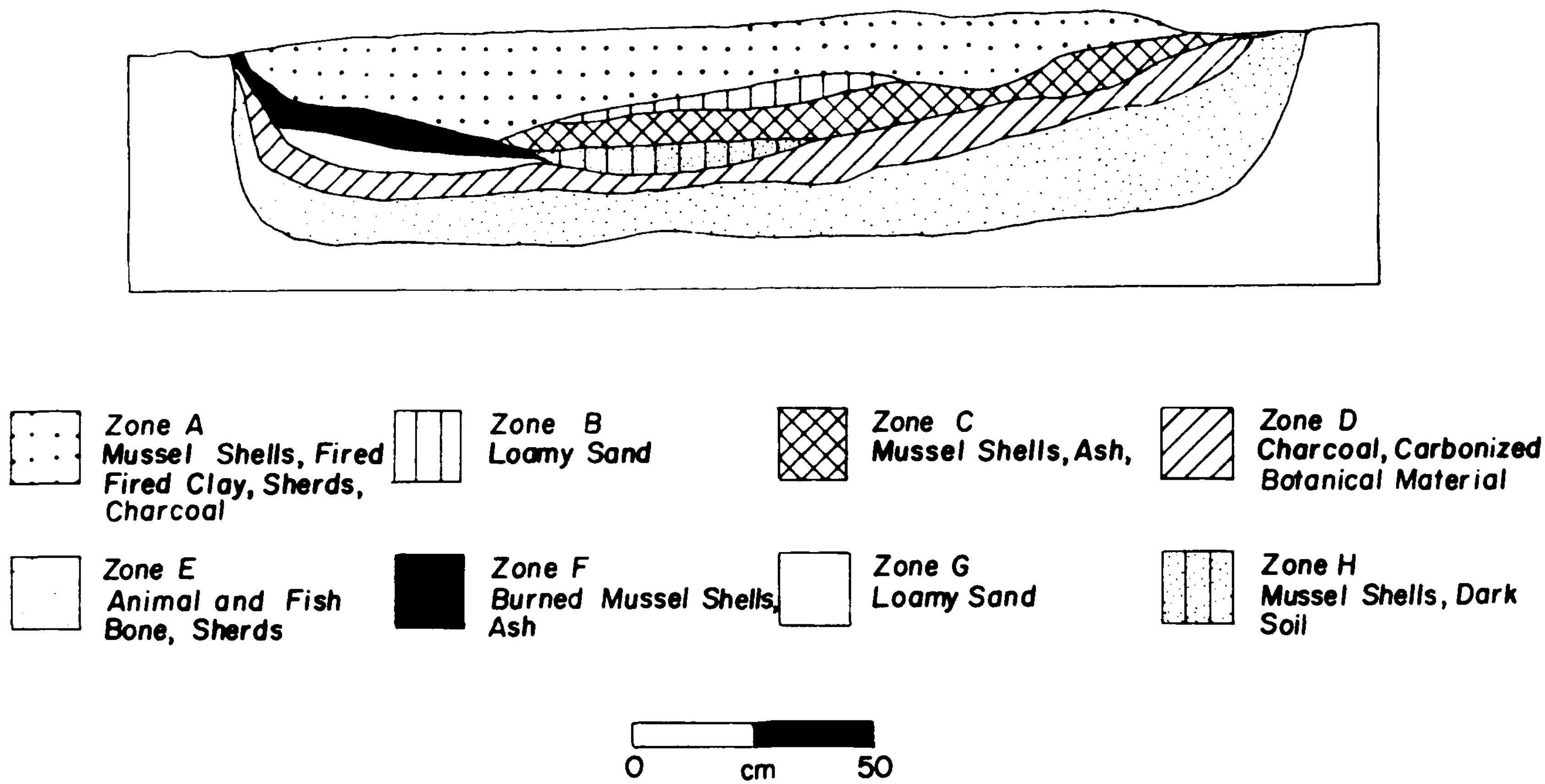

Figure 2. Profile of Pit 32 in Hectare 300N/-300E.

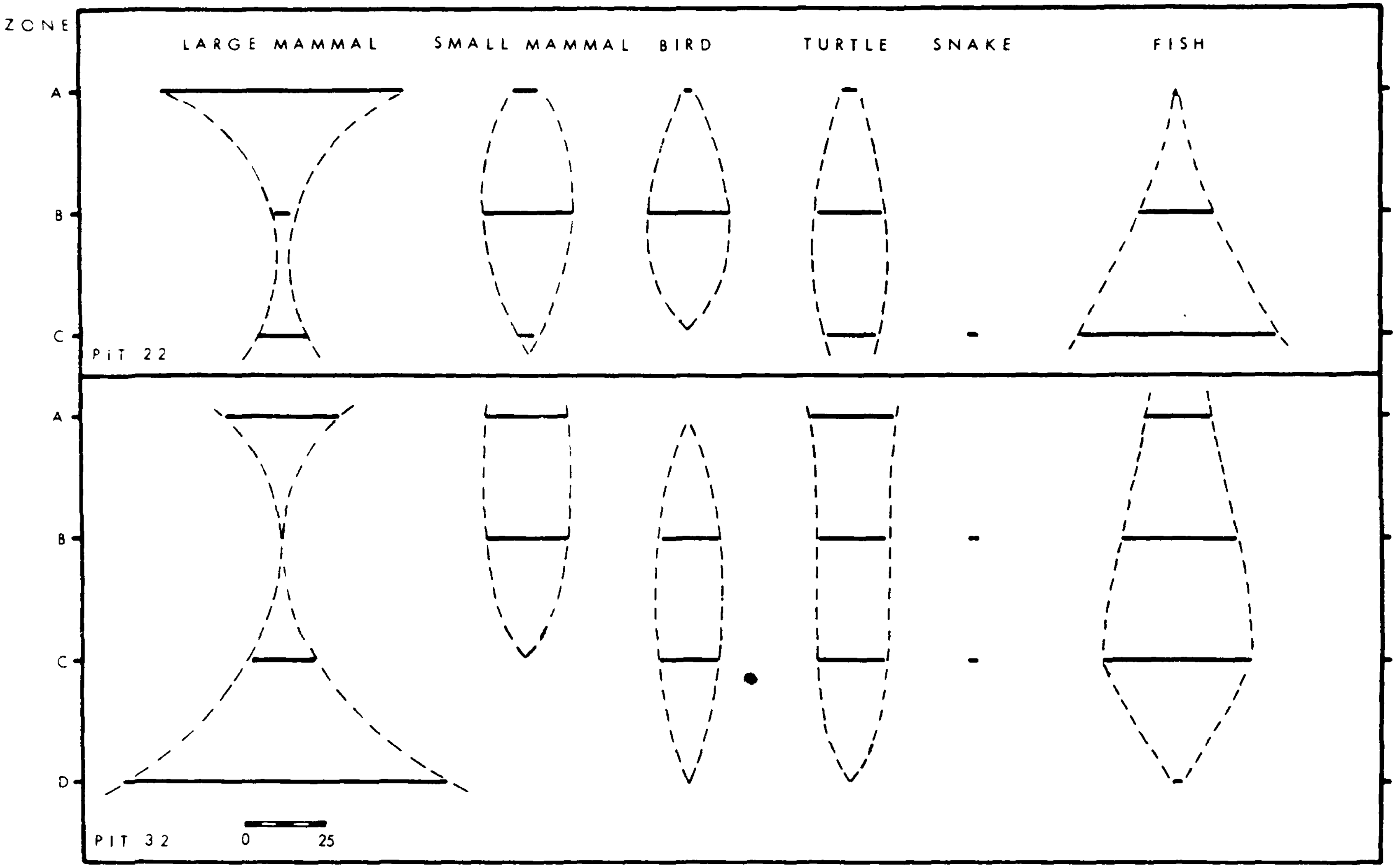

Figure 3. Changes in the relative proportions of taxa in two Middle Miller III stratified pits.

TABLE 9: Faunal Remains from Middle Miller III Stratified Pits in Hectare 300N/-300E'

Feature Zone	Identification	Pit 20 Ct.	%	Wt. (g)	%	Species Identified	Pit 22 Ct.	%	Wt. (g)	%	Species Identified
A	Large mammal	22	81	2.9	83		4	29	6.8	87	Deer
	Small mammal	1	4	.1	3		5	36	.6	8	Rabbit
	Bird						1	7	.1	1	
	Turtle	2	8	.3	9		4	29	.3	4	Mud-musk
	Snake										
	Amphibian	1	4	.1	3	Bullfrog					
	Fish	1	4	.1	3	Catfish					
	Molluscs	2		23.0			22		109.0		
B	Large mammal	4	80	1.3	93		2	2	.5	4	
	Small mammal						26	29	3.6	25	Opossum, Fox, Rabbit
	Bird						19	21	4.1	29	Black tern, large bird
	Turtle	1	20	.1	7		19	21	4.2	30	Mud-musk, <u>Chrysemys/Graptemys</u>
	Snake										
	Amphibian										
	Fish						24	27	1.8	13	Cat, Sun, Drum, Yellow Bass
	Molluscs	2		7.0			609		2987.0		
C	Large mammal	3	15	.8	20		2	4	.5	12	
	Small mammal						2	4	.2	5	
	Bird	1	5	.1	3						
	Turtle	13	65	1.7	43	Mud-musk	7	13	1.4	33	Mud-musk
	Snake						1	2	.1	2	Coachwhip
	Amphibian	1	5	.1	3	Bullfrog					
	Fish	2	10	1.3	33	Catfish, Sunfish	42	78	2.1	49	Bow, Cat, Sun, Drum, Walleye
	Molluscs	63		472.0			639		4333.0		
D	Large mammal										
	Fish										
	Molluscs	4		17.0							

TABLE 9 (Continued): Faunal Remains from Middle Miller III Stratified Pits in Hectare 300N/-300E.

Feature		Pit 32'					Pit 33				
Zone	Identification	Ct.	%	Wt. (g)	%	Species Identified	Ct.	%	Wt. (g)	%	Species Identified
A	Large mammal	6	20	1.6	31		3	23	.8	19	
	Small mammal	4	13	.9	18	Raccoon, Bobcat					
	Bird										
	Turtle	11	37	2.0	39	Mud-musk, Chrys./Grapt.	7	54	3.2	74	Cooter/Slider
	Snake										
	Amphibian										
	Fish	9	30	.6	12	Sunfish	3	23	.3	7	Catfish, Walleye
	Molluscs	176		973.0			193		1843.0		
B	Large mammal										
	Small mammal	6	12	1.5	21						
	Bird	2	4	1.4	20						
	Turtle	10	20	2.4	34	Chrysemys/Graptemys	1	100	3.0	100	Chrysemys/Graptemys
	Snake	1	2	.1	1	Viper					
	Amphibian										
	Fish	30	61	1.6	23	Bow, Sucker, Cat, Sun					
	Molluscs	488		2990.0			6		40.0		
C	Large mammal	1	1	1.4	17						
	Small mammal						1	13	.2	18	
	Bird	2	3	1.3	16	Large bird	2	26	.4	36	
	Turtle	14	19	2.9	35	Mud-musk, Softshell	2	26	.3	27	Mud-musk
	Snake										
	Amphibian	4	5	.2	2	Frog					
	Fish	53	72	2.5	30	Bowfin, Catfish, Sunfish	3	38	.2	18	
	Molluscs	375		3616.0			47		514.0		
D	Large mammal	5	83	22.9	100	Deer					
	Fish	1	17	.1	<1						
	Molluscs	10		24.0							

Zone B of Pit 32 is a combination of USN 2010, 2011, 2014, 2015, and 2016.

sunfish vertebrae recovered from the underlying zone (Zone C) which were from a fish (or fishes) two years of age. Both vertebrae exhibited growth beyond a recently formed annulus. Since annulus formation occurs between May and mid-June in two-year old large mouth bass in Tennessee (Carlander 1969:247), Zone C probably accumulated during mid-summer.

Zone A, overlying the late summer refuse in Zone B of Pit 22, yielded primarily deer and unidentified large mammal fragments. This stratum probably includes fauna procured in October or November. The single deer mandible recovered from the Middle Miller III sample was from an individual estimated to have been between 14 and 15 months of age, which, assuming an August 1 birthdate (Davis 1979; Golley 1962), would place the onset of the deer harvest between mid-September and mid-November. Unfortunately, this mandible was recovered from one of the unstratified Woodland features (Pit 21).

To summarize the seasonal evidence from Pit 22: the lowest zone was filled with fish apparently procured during mid-summer; the overlying zone produced a migratory bird commonly seen in the area in August and September; the upper zone yielded primarily large mammal remains, suggesting that the fall (October-November) procurement of deer had begun. The striking similarity between the proportions of fauna in Pit 22 and the upper three zones of Pit 32 can be seen in Figure 2. The major difference between these two features is that Pit 32 seems to have been completely filled by late summer or early fall, prior to any real emphasis on the procurement of large mammals.

These data suggest that large mammals were of little importance during the summer months, turtles were a minor but consistent source of meat in both summer and early fall, and fish assumed a less important role in the diet as cooler weather approached. Small mammals appear to have been exploited primarily in late summer and early fall. The following discussion will consider the species identified from the various zones of these features and where they seem to fit in terms of the overall timing of procurement. Seasonal habits and possible means of procurement are discussed only for turtles and fish. The reader is referred to Smith (1975) for a discussion of the technology used to capture mammals and birds.

Mammals:

Swanton mentions that in historic times, between planting and harvest, Southeastern Indians often had time for a "shorter hunt" (1946:256). Some large mammals (probably deer) were killed in the summer months during Middle Miller III. Given the paucity of large mammal remains, however, it probably was only an occasional event and was characterized by extensive sharing of fresh meat. Sharing, and hence immediate consumption, seems even more likely considering the heat and humidity of Alabama summers, for spoilage would have been quite rapid without immediate steps taken to reduce the moisture content of the meat either by drying or smoking (cf. Binford 1978:91-94), both of which are labor intensive processes.

It appears that the smaller mammals were not often procured during mid-summer, but were actively pursued as early as August or September. An opossum (Didelphis virginiana), a gray fox (Urocyon cinereoargenteus), and two rabbits (Sylvilagus spp.) were recovered from the same zone in Pit 22 which produced

the black tern. Raccoon (Procyon lotor) and bobcat (Lynx rufus) were identified from the upper stratum of Pit 32, which also appears to represent refuse accumulated in the late summer or early fall (see Figure 2). This season is somewhat earlier than the optimum period for exploitation suggested by Smith (1975:123) on the basis of behavorial data and seems less than optimal in other respects, for most of these species reach maximum weights and highest fat content in late fall or early winter (Reidhead 1976; Keene 1979).

There are several possible reasons for exploiting these mammals earlier than might be considered 'optimal'. For many of the species, river bottoms are the preferred habitat, and thus densities are higher than in upland areas (Golley 1962). If the fall-winter hunt entailed movement away from the river valley, exploitation of these mammals during the late summer or early fall would have been a viable and efficient option. A second possibility is that the meat was necessary to supplement the diet in the face of diminishing returns in fishing ventures. The results of a study of the food habits of large mouth bass in Oklahoma lakes suggest that hook and line fishing (see below) would be ineffective during cooler weather. Bass do not feed regularly at temperatures below 10 degrees C (50 degrees F). Between 38 and 50 percent of the bass caught in Oklahoma between May and August had eaten recently, as opposed to only 13 percent of those caught between September and April (Carlander 1969:265). A third possibility is that some effort was made to take advantage of the passive pursuit opportunities afforded by all of these species. Traps or snares could be set in favorable locations, and aside from the energy necessary to manufacture and assemble the materials and the energy expended in checking the traps regularly, time could be devoted to other tasks including the collection and preparation of plant foods for storage.

Birds:

Only two birds were identified from the Middle Miller III sample in Hectare 300N/-300E, the black tern mentioned previously and a year-round resident, wild turkey (Meleagris gallopavo). Smith (1975:80) suggested November through March as the probable season of exploitation for the latter species because wild turkeys aggregate in fairly large flocks during the fall and winter. The single turkey bone recovered in the Middle Miller III sample came from the north half of Pit 20 (which was excavated as a unit) and thus is not assignable to a stratum. Although the faunal sample from Pit 20 is too small to reliably ascertain probable season of deposition for each zone, an increase in large and small mammals in the upper stratum suggests a summer or early fall provenience for at least part of this feature. Most of the unidentifiable "large bird" listed in Table 9 is also probably wild turkey. There are very few birds in this size range that are summer residents in Alabama other than raptorial birds, which, unlike turkeys, are characterized by low population densities because of their position near the top of the food chain. If the "large bird" in these features is turkey, this species was exploited in both summer (Pit 32, Zone C) and early fall (Pit 22, Zone B).

No consistent patterning was noted in the occurrence of birds in any of the stratified pits in Hectare 300N/-300E. The erratic occurrence of bird bone in these deposits could be due to a pattern of exploitation in which birds were not consistently pursued during the summer and early fall, but rather were procured as the opportunity arose. Sampling error, however, cannot be ruled out given the tiny sample size.

Reptiles and Amphibians:

Turtles seem to have supplied a minor but consistent source of meat throughout the summer and well into the autumn. In Alabama, most turtles and snakes are active in all but the very coldest months (November through February), and many species emerge from a torpid state on warm days in mid-winter (Mount 1975; Ernst and Barbour 1972). These reptiles could have been captured in a number of ways which in the prehistoric period could have included spearing, trapping, dip nets, set-lines, or bow and arrow (Carr 1952; Lagler 1943). Unfortunately, no mention is made of the technology in use at contact in early ethnohistoric accounts.

The most important turtles in the Middle Miller III diet were the aquatic members of the family Emydidae (Chrysemys/Graptemys). Basking, a habit that is particularly well developed in this family, often results in highly visible, large aggregations of turtles. This behavior could have been exploited in two ways: either by shooting the individuals with bow and arrows or by placing basket traps adjacent to basking locations. Lagler (1943:22) found the latter to be effective exclusively for this family. Sunning in locations near shore would leave these turtles vulnerable to a bow hunter, although this method may have been ineffective without some means of retrieval such as an attached line with a float or some other marker.

> Certain species are easily shot [with a gun], but shooting is not effective if one wishes to recover specimens. Even if instantly killed, they are sometimes lost, and wounded specimens quickly hide themselves in soft bottom material or dense vegetation (Lagler 1943:21).

Lagler discounts spearing as an efficient means of capture because the target is generally small, moving rapidly, and great force is required to penetrate the hard shell of most turtles. Set-lines require a wire leader for the capture of any other than very small turtles (ibid:22). Basking is most commonly observed in late spring, summer, and early autumn. The occurrence of basking turtles (Chrysemys/Graptemys) in Zone B of Pit 22 and Zones A and B of Pit 32 indicates exploitation of these species at least through late summer or early fall.

Only one fragment of a box turtle (Terrapene carolina), was recovered from the Middle Miller III sample. This terrestrial species is easily procured by hand. Box turtles are more active and more commonly observed in spring and fall than during hot weather (Ernst and Barbour 1972:89). The sole fragment of this species was recovered from the north half of Pit 20, thus precluding speculation regarding the probable season of exploitation. However, it is notable that this species is rare in the predominately summer Middle Miller III faunal assemblages, particularly in comparison to the Mississippian sample.

Although the bulk of the turtle biomass in the Woodland diet appears to have been supplied by pond or marsh turtles (Chrysemys/Graptemys), members of the mud-musk family (Kinosternidae) are more abundant by count (cf. Appendix A) and are represented in nearly all of the Middle Miller III features. The frequency of mud-musk turtles is interesting in several respects. These turtles are not considered edible today since all members of the family emit an unpleasant substance when disturbed. Carr refers to the odor emitted by

mud turtles (Kinosternon spp.) as "nauseating," but adds that it is "far from being as utterly revolting as the stench that exudes from a hysterical stink-jim [Sternostherus spp.]" (Carr 1952:104). Whether or to what extent this noxious substance permeates the meat is not mentioned by Carr or others since none seem to be aware of mud-musk turtles being used as food. These turtles could have been procured with the methods suggested for Emydine turtles since they leave the water to bask occasionally. Dip nets would also have been effective, for mud-musk turtles are neither fast nor agile in the water. In addition, these small turtles "are easily caught on hooks with nearly any kind of bait of animal origin" (ibid:81). Since mud-musk turtles prefer slow-moving, shallow to moderately deep bodies of water with soft bottoms and abundant aquatic vegetation (Ernst and Barbour 1972), precisely the preferred habitat of the majority of the fish species recovered from the Middle Miller III sample, the high frequency of mud-musk turtles may be a by-product of some of the fishing activities at the site.

Softshell turtles (Trionyx spp.), the only other turtle family identified from the sample in Hectare 300N/-300E, was represented by only three bone fragments. This low frequency of softshells is particularly notable considering that every fragment of the carapace or plastron is identifiable by virtue of the patterning on the outer surface of the bone.

Soft-shell turtles are extremely fast and agile in water and do not bask frequently. Mount (1975:310) notes that

> ...they would be difficult to collect were it not for the habit of burying themselves in mud or sand in shallow water. A slightly mounded, disturbed area often reveals a turtle's presence to the collector.

However, according to Carr (1952:428-429), softshells commonly burrow in shallow water only during the winter. During warm or hot weather, softshells frequent deeper water -- which would seem to preclude hand collection. Carr notes, however, that softshells are occasionally caught on trot-lines, though not in great numbers (ibid:433). The rare occurrence of this family in the Middle Miller III sample might also be a result of procurement incidental to fishing activities.

Snakes and frogs were frequently present in the same zones of Middle Miller III pits which yielded fish. According to a Choctaw myth, these species were eaten "during times of famine" (Campbell 1959:13). Whether or not these occurrences are the result of famine conditions is difficult to evaluate. These taxa are relatively more abundant in this sample than in Mississippian samples, but this difference could be seasonal in origin.

Fish:

The seasonal nature of fish utilization has been mentioned in the preceding discussion. Annulus formation on fish vertebrae corroborates ethnohistoric accounts of procurement during summer. Furthermore, the species composition and the size of the individuals recovered from the 300N/-300E Middle Miller III sample suggest that the majority of the fishes were either collected by hand or caught with hook and line -- neither of which would have been effective procurement strategies during cool or cold weather. Many of the fish recovered in the 300N/-300E sample were too small to have been

procured by spearing. Over 50 percent of the individuals in the sample are estimated to have weighed less than .25 kg (.55 lb) and would have provided an extremely small target (Table 10). Hook and line fishing is documented by a small bone fishhook fragment recovered from Zone C of Pit 32, a deposit dominated by bowfin, catfish, and sunfish remains. As mentioned previously, this method would not have been effective once temperatures dropped below 10 degrees C.

Hand collection, a technique first suggested by Parmalee et al. (1972:23-24) to account for an archaeological sample showing great diversity in species composition and size, has been demonstrated to be an extremely efficient means of harvesting this resource (cf. Limp and Reidhead 1979) in areas where seasonally low water conditions concentrate fish in shallow, impounded pools. Such conditions would apply to the study area from mid-summer to early fall in years of unusually low rainfall. If hand procurement was the most commonly used method of capture, however, schooling fish such as the herring family should occur in much higher frequencies than is true of the present sample. Limp and Reidhead, for example, found that 50 percent of the fish biomass collected in slough fishing experiments in the Illinois Valley was made up by gizzard shad. Shad are undoubtedly more numerous today than prehistorically. These bottom feeders prefer silty substrates, a habitat which has increased markedly with the extensive land clearance and dam building of the last century. Regardless of this recent increase in abundance, however, unless shad and other members of the herring family were rejected as a food resource, non-selective procurement techniques such as hand collection or fish nets should have produced more than the single individual identified from the Middle Miller III sample.

The fishing technology which could account for the species composition of the Middle Miller III sample is the use of hooks and lines. Herrings, minnows, and chubsuckers -- all species which rarely take a hook -- are each represented by only one individual. Catfish, sunfish, bowfin, and drum, the dominant species in the assemblage, will readily take a baited line. In addition, the gar family (Lepisosteidae) was notably absent in the sample. Due to their sharp teeth and powerful jaws, gars are difficult to take on hook and line without a wire leader (Pfleiger 1975:66).

If hook and line fishing was the primary fishing method, then there appears to have been a technological upper limit to the size of the fish caught. Only four fish are estimated to have weighed more than 1 kg (2.2 lb.). This suggests that the sinew or vegetable fiber used to manufacture fishing line could withstand pressures no greater than about 2 pounds. Bass (Micropterus spp.) are perhaps the best yardsticks of the strength of a line since they are commonly regarded as the ultimate test of an angler's prowess. The largest bass in the sample weighed .73 kg (1.6 lbs.) and the next largest, .53 kg (1.1 lbs.). The largest fish recovered from the 300N/-300E assemblage, a catfish weighing ca. 2.78 kg (6.1 lb), was probably procured by other means.

Given the apparent limitations of the aboriginal hook and line, fishing in the main channel of the Tombigbee for larger fish would have been, in effect, a waste of the hours invested in the manufacture of fishing equipment. Species composition suggests that most fishing activities took place either in a backwater area, possibly an oxbow lake, or in one of the creeks flowing into the Tombigbee near the site. Table 11 illustrates the findings of a recent

TABLE 10

[illegible] weights of Fish Fauna from Middle Mill[illegible] III Features Hectare 300N - 300E and (Hectare 400N [illegible])

	1 kg	1 to 25 kg	25 to 5 kg	.5 to .75 kg	75 to 1.0 kg	1.0 kg	Maximum Weight (kg)
[illegible]			1	1	3	2 (1)	1.36 (2.73)
[illegible]			1				
[illegible]		1					
M[illegible]	1						
[illegible]			1 (1)				
S[illegible]		(1)					
[illegible] (family)	1						
Catfish (Ict. spp.)		1	1				
[illegible] catfish	2	1		1		1	2.78
Blue-Channel catfish					1		
[illegible] Bullhead	2	2					
Black Bullhead	1						
Yellow Bullhead	1						
Madtom	(1)						
Flathead catfish		1					
Sunfish	1	2					
Bluegill (*Lepomis* spp.)	3	2	1				
Bass	1	(1)	3	2			
Crappie	1	4					
Perch (family)			2				
Walleye				1			
Drum			1	(1)	1	1 (1)	1.66 (5.90)
Yellow Bass			1				

TABLE 15

Subsample of Mississippian Features

Hectare	Feature Type and Number			Quantity of Bone		Cultural Affiliation
	Midden	Pit	Other	Pieces	Wt. (g)	
300N/-200E	x			108	60.9	Mississippian
		29		33	32.2	Mississippian
		31		35	21.8	Mississippian
300N/-300E	x			272	62.6	Mississippian
		4		27	16.9	Mississippian
		6		55	63.7	Mississippian
		21		81	25.7	Summerville II-III
		23		104	70.6	Mississippian
		33		49	15.9	Mississippian
400N/-200E	x		Shell midden	296	66.3	Mississippian
400N/-300E		0		4035	2158.7	Summerville II-III
		4		27	16.9	Mississippian
		8		267	158.3	Mississippian
		40		111	18.9	Summerville IV
		69		27	33.8	Summerville IV
		83		84	82.6	Mississippian
		86		114	51.2	Mississippian
		109		35	14.3	Mississippian
		131		49	24.8	Mississippian
		144		33	18.8	Mississippian
		146		41	87.0	Summerville II-III
		152		83	55.2	Summerville II-III
400N/-400E	x			2917	997.5	Mississippian
		1		48	13.4	Summerville II-III
		4		61	27.5	Mississippian
		7		71	36.9	Summerville II-III
		10		438	193.8	Mississippian
		16		105	105.3	Mississippian
		20		130	66.3	Mississippian
		21		33	15.9	Summerville II-III
		25		29	17.5	Summerville II-III
		28		98	78.1	Summerville II-III
		45		124	51.9	Summerville II-III
			Wall Trench 1	62	23.0	Summerville II-III
400N/-500E		13		18	15.8	Mississippian
Mound (1P185)	x			1173	1183.8	Summerville II-III
			Sand fill, stage 2	220	121.6	Summerville II-III
			Clay cap, stage 3	26	10.7	Summerville II-III
			Sand fill, stage 4	686	246.6	Summerville II-III
			Clay cap, stage 4	244	172.3	Summerville II-III

was also used in the calculation of minimum numbers of individuals for the Mississippian sample as a whole. All of the subsampled features are listed in Table 15.

The analysis and discussion that follows is presented in four parts. First, Mississippian patterns of refuse disposal are described briefly, and variability in content and modification of bone in different types of deposits is discussed. With the aid of recent ethnoarchaeological research, an attempt is made to derive a set of archaeological expectations for the content of assemblages resulting from the processing of venison for storage. Second, the relative importance of the various faunal taxa is explored and compared with both ethnohistoric accounts and previous research on Mississippian subsistence. Third, the differential distribution of subsistence remains in mound and village deposits is discussed. Finally, the results of the analysis are summarized briefly.

1. Patterning in Refuse Disposal

Michael Schiffer (1972) postulated that as population density or sedentism increase, greater effort is expended by human populations in discarding refuse at locations removed from habitation areas. Although refuse pits and middens were found in many of the excavated areas, including what appeared to be habitation areas, this postulate is generally supported by this sample. Large refuse pits and middens were never found to be contemporaneous with nearby structures. A few small refuse pits were recovered occasionally in or near contemporary structures, but these pits invariably yielded very limited faunal samples and probably were used for the expedient removal of small quantities of accumulated debris.

The customary Mississippian patterns of refuse disposal appear to differ significantly from those observed for the Late Woodland occupation. Most Mississippian pits and middens were very shallow, and none exhibited the distinct, seasonally progressive stratification characteristic of some of the Late Woodland features. The absence of laminae in Mississippian features could be explained in two ways: 1) because the pits were not deep, refuse was subsequently disturbed by postdepositional annelid, rodent, or agricultural activity; or 2) refuse locales were used more frequently, with insufficient time elapsing between discard episodes for stratification to be apparent in the content of the fill or as weathered laminae. Both factors probably contributed to the observed homogeneity of deposits. Some of the difficulty encountered in the dating of Mississippian deposits was the direct result of extensive postdepositional disturbance. Fairly frequent refuse disposal is suggested, however, by the paucity of carnivore gnawed bones in all Mississippian features including faunal samples from secondary deposits such as mound fill and the ditch (Table 16). This low frequency of carnivore gnawed bone could be due to the complete destruction of bone refuse by village dogs, however.

Refuse filled deposits were described in the field as either refuse pits or middens, depending on whether the areal extent of the deposit was greater than 100 m^2. The absence of extensive sheet middens in the village was considered rather curious given the population size (between 150 and 300 persons) and the warm climate of Central Alabama. Binford (1978) noted that the Nunamiut Eskimo discarded bone refuse in localized areas during the summer

during this period. In addition to harvesting greater quantities of deer, the extremely small size of the fish in the Middle Miller III assemblage from the Lubbub Creek Archaeological Locality suggests an attempt to increase the quantity of fish available for consumption.

For hunters and gatherers, the problem with intensifying subsistence pursuits is that this strategy is subject to the law of diminishing returns. The yields of wild resources are naturally restricted, and as a result harvesting increasingly greater quantities of wild foods results in sharply rising labor demands. Under these circumstances, increased reliance on the expandable yields of agriculture, though also labor intensive, would eventually have become a less costly option (Earle 1980; Scarry 1980). In fact, the intensification of corn agriculture probably occurred in the subsequent Late Miller III period. The proportions of faunal taxa in Late Miller III samples from the Gainesville Lake show a relative increase in the quantity of deer and decreased emphasis on both turtles and fish -- a trend which continues into the Mississippian period. This renewed emphasis on deer and the decreased importance of aquatic resources was probably made possible by a modification in trophic relationships in which, per capita, the human population consumed greater quantities of plant foods and correspondingly lesser quantities of animal protein.

THE MISSISSIPPIAN OCCUPATION

During the Phase II and Phase III excavations, a very large sample of faunal remains was recovered from a total of 217 Mississippian features in the Lubbub Creek Archaeological Locality. Because the more than 30,000 bone fragments came from a number of depositional contexts, the faunal sample was suitable for addressing spatial variability in activities and subsistence in addition to assessing the relative importance of the various species as food items.

In discussing site formation processes, Schiffer (1972 and elsewhere) has drawn a distinction between "primary" and "secondary" refuse, the difference being that primary refuse is discarded at the location of use, while secondary refuse is spatially removed. Nearly all of the fauna analyzed for this study is secondary refuse, excluding the animal bone recovered from structure floors. However, the fact that the faunal materials are from secondary deposits does not necessarily mean that the deposits were not activity or season specific. Collectively, the features represent a number of depositional processes and events, ranging from the random inclusion of faunal refuse in sediment excavated from a protohistoric fortification (the "ditch") as a result of erosion, to the purposeful disposal of refuse in localized areas by the prehistoric inhabitants. Clearly, only the latter features are of interest in attempting to discern patterning in the association of animal species or anatomical parts which could reflect human behavior. Therefore, a subsample of Mississippian features was drawn to address these questions.

This subsample was limited to those features which appeared to have been used solely for the purpose of refuse disposal --i.e., refuse pits and middens -- provided the faunal assemblage yielded at least 10 g and at least 10 pieces of bone identifiable to class. Forty-nine features met these criteria. This subsample, with the addition of large faunal assemblages from deposits that were the result of rapid depositional events (mound fill and walltrenches),

TABLE 14

Comparison by Weight of the Relative Contribution of Faunal Resources other than Large Mammals during Miller III.

	Early Miller III	Middle Miller III	Late Miller III
Small Mammal	21.8%	17.1%	22.5%
Bird	15.7%	14.4%	38.1%
Turtle	55.6%	53.1%	30.5%
Fish	7.6%	15.4%	8.9%

proportions of taxa other than large mammals in these Late Woodland assemblages; and the inferred relationship between Middle Miller III population and the natural resources in their environment.

Without belaboring the point, fauna from Middle Miller III samples in the Lubbub Creek Archaeological Locality strongly suggest an occupational hiatus extending from mid-fall to early or mid-winter. The single deer in the Middle Miller III assemblage which could be assigned age at death was probably procured in October or November. In contrast, deer mandibles in the faunal samples from the Mississippian period in the Lubbub Archaeological Locality suggest that procurement of this resource peaked in December.

Seasonal relocation is also suggested when the contribution of taxa other than large mammals are compared for Early and Middle Miller III. If large mammal remains are excluded in the calculation of percentage contribution by weight of the various taxa, the major difference between Early and Middle Miller III is the abundance of fish remains in the latter period (Table 14). Since fishing does not appear to have been a fall activity, but small mammals, birds, and turtles were exploited to a limited extent during this season, such weighting of proportions is to be expected if the fall season is not well represented in Middle Miller III assemblages. Furthermore, the absolute difference between these two subphases in the percentage contribution by weight of small mammals, birds, and turtles generally corresponds to the proportions of the same taxa in Zone A of Pit 22 (cf. Table 9) which has been interpreted as early to mid-fall refuse.

Finally, it should be emphasized that an imbalance between Miller III populations and the natural resources available in the river valley may have existed. Miller III settlements, though small, are extremely numerous in the Tombigbee Valley. If only 10 of the 21 Miller III "base camps" located by Jenkins et al. (1975) in the Gainesville Lake survey were contemporaneous, the "average" village catchment would have had a radius of between 4 and 4.5 km (2.6 - 2.8 miles) before the territory of the neighboring village was trespassed. While hunting parties could have travelled to areas away from the river valley, it eventually may have become cost effective simply to relocate most or all of the population (cf. Binford 1978), particularly during years of game scarcity.

If such an imbalance between resources and the human population did exist, two options would have been available to alleviate resource shortages: diversification of the resource base -- i.e., the addition of new subsistence strategies; or the intensification of existing subsistence strategies -- i.e., harvesting greater quantities of the same resources. Diversification, the lower cost option, should be manifested archaeologically by the addition of new species of plants and animals to the resource base. Because previous studies of faunal remains in the Gainesville Lake have been hampered by a lack of comparative osteological specimens, this possibility cannot be fully evaluated at this time. However, the similarity between the proportions of various taxa (other than large mammals) in Early and Middle Miller III samples argues that diversification of the resource base had occurred prior to Middle Miller III. If diversification was no longer possible, the only remaining option would have been the intensification of existing strategies. The settlement shift postulated to explain the proportions of taxa in Middle Miller III assemblages would suggest an intensification of deer exploitation

reliably infer seasonality.

In addition, it should be pointed out that charred acorn and hickory nuts were encountered in nearly all zones of these features, including the strata yielding spring and summer refuse. The presence of these species often is interpreted as evidence of a fall occupation when, in fact, nut foods can be stored for long periods of time and used throughout the year. The only seasonal correspondence between animal and plant remains was a grape seed recovered from Zone B of Pit 22 (late summer to early fall). The lack of seasonal agreement between faunal and floral remains suggests that seasonality cannot reliably be inferred strictly on the basis of charred plant remains. Animal bones are a much more reliable source of seasonal information. Even if the meat of certain species was stored, it undoubtedly was "filleted" and the bone refuse discarded prior to storage.

III. Discussion

The importance of various animal species in the subsistence system of the Middle Miller III population cannot be evaluated completely with the sample from the Lubbub Creek Archaeological Locality because remains from the fall and winter hunt are not well represented. The absence of this portion of the annual economic cycle seriously skews the quantification of animal resources because the majority of the meat consumed probably was procured during this season and either eaten immediately or processed for storage.

As noted previously, other research on prehistoric subsistence in the Gainesville Lake suggests increasing diversity in the Late Woodland, with deer remains decreasing in abundance in relation to other fauna. This trend is especially marked between Early Miller III and Middle Miller III when the percentage by weight of deer remains in the Gainesville Lake sample dropped from 88.0 percent to 70.9 percent (Woodrick 1979). Relatively low percentages of deer are also characteristic of the Late Miller III faunal assemblages analyzed by Woodrick. Three explanations are possible for the observed pattern: 1) deer remains were discarded in a fashion not amenable to preservation or recovery; 2) the fall and winter hunt took place at another location, perhaps with dried meat being returned to settlements in the river valley; or 3) the Late Woodland peoples were, in fact, diversifying their resource base by concentrating more on aquatic resources, and small mammals.

Poor bone preservation is a possible explanation for the paucity of deer bone in the present sample because of the generally low pH characteristic of soils in the Lubbub Creek Archaeological Locality. Only deer teeth survived the thousand years between discard and excavation in the absence of the counteracting high pH of mussel shell. Osteological evidence of species exploited during the fall may be lacking because molluscs were not extensively harvested during this season. In all fairness, however, it should be noted that similarly poor conditions of preservation apply to faunal assemblages from other sites in the Tombigbee Valley. For this reason, it appears that poor bone preservation cannot be invoked as a plausible explanation for the observed pattern.

Several lines of evidence suggest that the unusually low quantity of deer bone in Middle Miller III faunal assemblages is the result of relocation during the fall: the seasonal evidence cited in this paper; the relative

TABLE 13

Suggested Seasons of Exploitation for Species Identified in the Middle Miller III Sample.

	Late(?) Winter	Early-Mid Spring	Mid-Late Spring	Summer	Late Summer	Early Fall	Mid Fall
Opossum					X	X	
Raccoon					X	X	
Fox					X	X	
Bobcat					X	X	
Squirrel*	O	O	O		X?	X?	
Rabbit			O		X	X	X
Deer	O	O	O	X?	X?	X	X
Turkey*	O?		O?		X?	X?	X?
Migratory birds		O			X	X	
Mud-musk turtles		O		X	X	X	X
Slider/Cooter/Map Turtle				X	X	X	
Box Turtle*					X?	X?	
Softshell Turtle*		O	O	X	X?	X?	
Snakes				X			
Frogs/Toads				X			
Fish		O	O	X	X	X	
Molluscs			O	X	X	X	

Key: O - species identified in samples from Hectare 400N/-500E
X - species identified in samples from Hectare 300N/-300E
* - species identified in samples from Hectare 300N/-300E but not assignable to a stratum
? - some uncertainty exists due either to lack of provenience or identification problems

necessary to plant, tend, and harvest corn. Given the scheduling of labor resources necessary to insure an adequate harvest, the seasonal procurement of animal resources may have been altered in some respects in comparison to a subsistence system more heavily dependent on the harvesting of wild plant foods.

Table 13 should be considered a very tentative outline of animal procurement because the sample is very small and does not include all of the species known to have been utilized by Middle Miller III peoples (cf. Woodrick 1979). Negative evidence may suggest that a certain species was not taken during a given season, but until a larger sample is available, this interpretation cannot be considered reliable.

.Several generalizations can be made on the basis of this sample, however. The findings of this study of seasonality are essentially in agreement with Bruce Smith's (1975) proposition that fish, turtles, and possibly rabbits would have been harvested in late spring and, except for the latter, through the summer, and that all other primary prey species would have been pursued most actively in fall and winter. These data can be used to further refine some of Smith's ideas, however.

First, deer were probably exploited to a very limited extent during spring and summer. Secondly, it appears that a wide array of small mammals, including raccoon, fox, bobcat, opossum, and rabbits, were pursued in late summer and early fall, but were largely ignored once the deer harvest began in October or November. Squirrels seem to have been most commonly hunted in the winter and spring and almost completely ignored during summer and fall. Of the 16 squirrel bones recovered from the Middle Miller III sample, 15 came from Pit 28. This observation is in partial agreement with Smith's suggestion that squirrels were most likely hunted "in late fall and early winter when cover was at a minimum, since it would have been much easier during this time of year to locate the animals themselves and their nests..." (1975:113). Exploitation of squirrels apparently continued well into the spring also. Excluding mid-summer, rabbits were hunted or trapped during all seasons for which evidence is available. Turtles were taken at least from early spring through early fall, and exploitation of some species occurred during the winter months as well. Only softshell and mud-musk turtles were recovered from Pit 28, but this cannot be considered conclusive evidence that basking turtles were not harvested in winter and spring. Fish utilization began as early as March and seems to have continued through September. Spears were probably used to procure fish during spawning runs in the spring; trot-lines were probably set out by late April or May; hand collection, if used at all, probably would not have been a viable option before mid-summer.

Mussels seem to have been collected primarily but not exclusively between April and October. A cautionary note regarding the interpretation of seasonality based strictly on mussels is necessary, however. Molluscs are present in virtually all of the Middle Miller III features and in all of the zones of the stratified pits. Whether the small quantities found in zones interpreted as winter, early spring, and mid-fall are due to post-depositional mixing, or whether they are present as a result of some limited collection of this resource during cold weather cannot be resolved at this time. Cold weather does not seem to have precluded the exploitation of softshell turtles. Until this issue is resolved, additional lines of evidence are essential to

the river had subsided in the spring, as argued by Woodrick (Chapter 5, this volume).

The remaining zones of Pit 28 vary considerably in the quantity of mollusc shell recovered, suggesting that the zones did not have a common season of origin. This variability is not surprising, however, given the function of the pit. If food, either nuts or maize, was stored in this feature, the month during which the food stores would be depleted might vary from one year to the next depending on the severity of the winter, the success of the fall-winter hunt, the quantity of corn and nuts harvested during the preceding autumn, and many other factors. Swanton states that "the harvest was seldom sufficient to last -- nor was it expected to last -- until another crop came in" (1946:256). This allusion to the depletion of winter stores suggests spring, or possibly winter, as the probable season for Pit 28 to be relieved of its storage function.

A second possible function of Pit 28 is storage of seed to sow the fields of the following year. If this pit was used for the storage of seed stock, it would explain the apparent lack of discretion shown in the kinds of material used to fill the pit once the grain had been removed. Such a function also would account for the variability in mollusc shell in the zones of this feature, for planting might be delayed for weeks or months depending first on weather and flood conditions and secondly on the timing of a possible second planting. The Timucua, for example, "sowed their corn twice a year, in March and June..." (Swanton 1946:269).

Regardless of the specific storage function of Pit 28, either winter or spring seem logically to be the most likely seasons of origin for the refuse recovered, a conclusion which supports interpretation of Zone D as early spring refuse. Deer, squirrel (S. carolinensis), softshell turtle, and an unidentified large bird were recovered from the other zones of Pit 28 that yielded little mussel shell. Exactly where in the yearly economic cycle these zones fit is impossible to say at this time. The refuse may be the result of either winter or early spring activities. Softshell turtles are active year-round and could have been procured in shallow water during the cooler months. The remaining zones, B and E, produced tremendous quantities of molluscs. In addition, other than the two suckers recovered from Zone D, Zones B and E were the only zones to produce fish remains, again suggesting the seasonal co-occurrence of fishing and mussel collecting. Both of these zones are dominated by deer and unidentified large mammal remains, unlike the "summer" refuse from Hectare 300N/-300E. If the sample from Hectare 300N/-300E is representative of species exploited during the summer, Zones B and E of Pit 28 probably represent refuse accumulated in mid to late spring.

Summary: Seasonal Procurement of Animal Resources

A summary of the most likely season or seasons of procurement for each species recovered from the Middle Miller III sample is shown in Table 13. This interpretation applies to the scheduling employed by a single Woodland population in the Tombigbee River Valley and thus may not be similar to the timetable followed prehistorically in other areas by human populations interacting with their environment under a different set of constraints. Cultigens were probably already of some importance during the Middle Miller III period since this settlement was occupied during all of the seasons

TABLE 12

Faunal Remains from Hectare 500N/-400E Middle Miller III Stratified Pit

Feature	Pit 28					
Zone	Identification	Pieces	%	Weight (g)	%	Species Identified
A	Large mammal Small mammal	13 1	93 7	8.6 .2	98 2	Deer Squirrel
	Molluscs	1		12.0		
[illegible]	Large mammal Small mammal Bird Turtle Fish	70 23 7 3 5	64 21 6 3 5	33.7 4.9 2.1 2.2 .5	78 11 5 5 1	Deer Squirrel, Rabbit Large bird Softshell Bowfin
	Molluscs	2983		4461.0		
D'	Large mammal Small mammal Bird Turtle Fish	20 8 4 4 10	43 17 9 9 22	15.9 1.0 .4 .9 .5	85 5 2 5 3	Deer Squirrel Blue-winged teal Mud musk Suckers
	Molluscs	12		60.0		
E	Large mammal Small mammal Bird Fish	12 5 8 10	34 14 23 29	8.8 .4 .5 2.8	70 2 4 22	Deer Squirrel Catfish, Drum
	Molluscs	1203		10,189.0		
F	Large mammal Turtle	1 3	25 75	19.0 1.5	93 7	Deer Softshell
	Molluscs	12		46.0		
G	Large mammal Bird	2 1	67 33	.8 .3	73 27	
	Molluscs	1		1.0		

'Zone C (USN 2184) is the designation for the pit "collar."

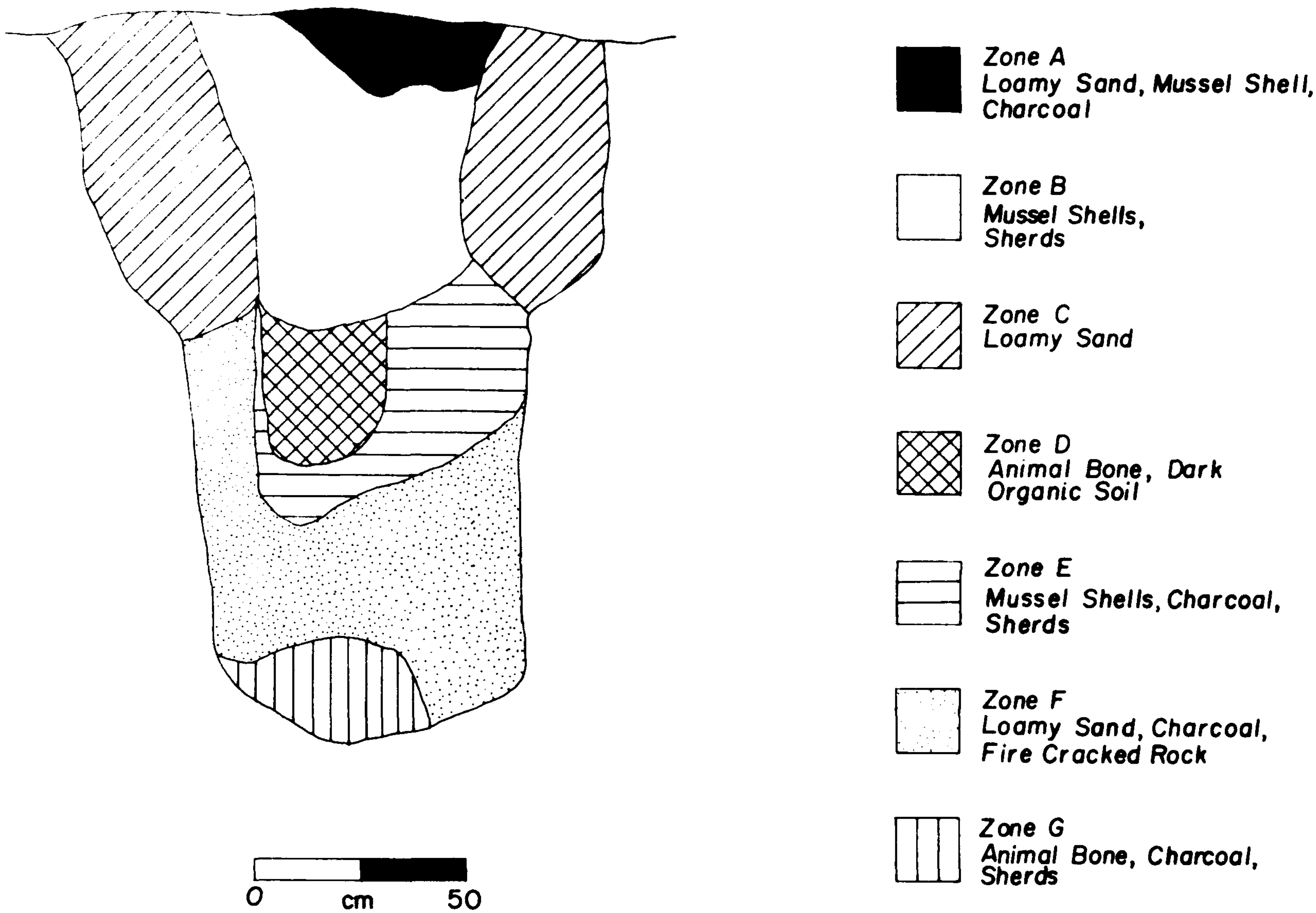

Figure 4. Profile of Pit 28 in Hectare 400N/-500E.

> The small family-size hole is about 6 ft deep and 5-6 ft wide, which holds about 2 tons of maize...These holes open to the surface by a narrow neck (about 2 ft in diameter)... The grain is filled into the pit until it is nearly level with the neck, and is then covered with a good layer of dung, or is first covered with light poles over which dung is laid. The neck is then topped up to ground level with the soil and a large stone is laid across the opening. Grain is reputed to have been successfully stored is such pits for 3 years although the normal storage period is 9-12 months (ibid:3).

The relative shape of Pit 28 is quite similar to that described above, although it is considerably smaller (Figure 4). A largely sterile collar (Zone C) surrounded the mouth of the pit, constricting it to a width of 50 cm (1.6 ft). The base of the feature measured 80 cm (2.6 ft) at the widest point, and the pit was 170 cm deep (5.6 ft). In addition, Pit 28 was located on one of the highest ridges in the Lubbub Creek Archaeological Locality, presumably to facilitate drainage.

This feature had alternately been filled with refuse and then re-excavated to less substantial dimensions a minimum of five times. This apparent re-use is curious, particularly considering that some food refuse -- subject, of course, to putrefaction -- was present in each stratum of the pit along with ceramics and lithic debris. This periodic filling and re-use may be accounted for by the fact that Pit 28 was intruded into a gravel bed, which undoubtedly produced several structural problems. First, this feature would not have retained a flask-shaped profile without considerable buttressing in construction. The collar, presumably constructed of clay, was necessary to constrict the mouth of the pit. Secondly, this feature, once emptied of its contents, would have been extremely unstable and would likely have collapsed if not immediately refilled. This instability is probably responsible for the gradually decreasing depth of the feature when functioning for storage purposes. Since this pit exhibits so much aboriginal disturbance, the fauna from each of the zones in the feature must be viewed as incomplete assemblages.

The count and weight of all bone which could be assigned to class, as well as the count and weight of mollusc shell, is shown in Table 12 for each zone in Pit 28. The zones vary markedly in the quantity of shellfish recovered.

Only Zone D produced a faunal assemblage that suggests a relatively restricted season of deposition -- probably early to mid spring. Recovered from this stratum were bones identified as deer, squirrel (S. carolinensis), blue-winged teal (Anas discors), mud-musk turtle (Kinosternidae), redhorse (Moxostoma spp), and chubsucker (Erimyzon spp). Blue-winged teals pass through Alabama in early autumn (September-October) and in early to mid spring (March-May), but are "more numerous in spring than in autumn" (Howell 1928:51). Both of the fish identified from this deposit are members of the sucker family. Suckers migrate into tributary streams during the spring to spawn in shallow water. At this time, are particularly vulnerable to spear fishing because large aggregations of fish are found in shallow water. Chubsuckers and redhorses are believed to spawn in March at this latitude (Cook 1959:86,88). It is notable that very little shell was recovered from Zone D, suggesting that the exploitation of molluscs did not occur until after

TABLE 11

Percent Occurrence of Woodland Fish Fauna in the Tombigbee River and Tributary Streams (after Boschung 1973)

Species	# of Occurrences in the Main Channel	# of Occurrences in Tributaries	% Occurrence in Tributaries
Bowfin	1	2	67
Shad/Herring	39	3	7
Grass pickerel	2	18	90
Minnow[1]	3	56	95
Chubsucker[2]	1	39	98
Brown Bullhead	1	7	88
Yellow Bullhead	3	14	82
Channel catfish	15	16	52
Madtom	24	80	77
Flathead catfish	8	2	20
Bluegill (etc.)[3]	53	233	81
Bass	27	47	64
Crappie	18	12	40
Walleye	1	0	0
Drum	14	1	7

[1]Data on Semotilus atromaculatus
[2]Includes data on all species of the genus Erimyzon
[3]Includes data on all species of the genus Lepomis

study of species distribution in the Central and Upper Tombigbee drainage (Boschung 1973). Ten of the fifteen species for which data are available were more commonly collected in areas other than the river proper. Species such as flathead catfish that can easily be caught on hook and line but are uncommon in the archaeological assemblage are infrequently encountered in tributary and backwater areas.

Angling, in the strict sense of one person tending one line, would have been highly impractical and economically unfeasible given the average size of the catch in the archaeological sample. Hook and line fishing was not often mentioned by early European colonists, probably because they "were so accustomed to this method of fishing that they took it for granted" (Swanton 1946:399). The few ethnohistoric references that make other than passing remarks of this technology document the use of trot-lines in the Southeast by the Powhatan tribes of Virginia, the Yuchi in Tennessee, and the Acolapissa of Louisiana (Rostlund 1952:116). The advantage of this type of fishing is that

> In contrast to angling, spearing, seining, the use of dip nets or of fish poison, methods that function only while the fisherman is on the job and operates the gear, trot lines are like traps or gill nets in that once they are set up they can be forgotten, and the fish is caught while the man goes about his other work (_ibid_:116).

Untended lines may have contributed to the small size of the catch, for larger fishes would have had ample time to break the line.

Molluscs:

Another interesting and informative aspect of the 300N/-300E Middle Miller III faunal assemblages is that the quantity of shellfish remains appears to covary with the abundance of fish. Woodrick (Chapter 5, this volume) suggested that molluscs were exploited after the subsidence of flood waters in spring but prior to the onset of cold weather. Mussel shell was abundant in all zones interpreted as summer and early fall, but were uncommon in the upper "mid fall" zone of Pit 22. Mussel shell was also rare in the lowest zone of Pit 32, suggesting that the refuse in this stratum originated during some other season.

<u>Hectare 400N/-500E</u>

Pit 28, the single Middle Miller III pit excavated in Hectare 400N/-500E which yielded faunal remains, was located in an area isolated from any [illegible] scatters of Woodland ceramics. This feature seems best interpreted as a storage pit which subsequently had been filled with refuse. Underground storage is still used in some parts of the world and has been found effective in reducing insect infestation of dry grain, provided an airtight seal is supplied (Hall, Haswell, and Oxley 1956).

According to Hall <u>et al</u>. (1956:3), primitive storage pits are often "flask shaped" and are located either under the roof of a dwelling where the grain (either wheat or maize) is protected from surface water or, if located outside, are constructed "on high ground or on hillsides, and provided with raised necks." In Somalia,

TABLE 15

(continued)

Hectare	Feature Type and Number			Quantity of Bone		Cultural Affiliation
	Midden	Pit	Other	Pieces	Wt. (g)	
500N/-300E		1		186	145.7	Summerville II-III
		47		199	207.8	Summerville II-III
			Wall Trench 4	44	18.5	Mississippian
500N/-400E	X			112	94.5	Mississippian
	X		Shell midden	1954	972.5	Mississippian
		4		1176	969.2	Summerville II-III
		9		360	179.7	Summerville I
		14		3560	3479.2	Summerville IV
		16		29	25.8	Summerville II-III
		31		263	308.6	Summerville II-III
		38		25	51.7	Mississippian
		41		36	94.5	Mississippian
		71		15	15.[illegible]	Mississippian
			Wall Trench 1	59	26.1	Mississippian
600N/-300E	X			821	397.6	Mississippian
600N/-400E		34		42	26.3	Mississippian
TOTAL				21,339	13,548.[illegible]	

TABLE 16

Distribution of Carnivore Gnawed Bone.

Hectare	Feature	Total Identified Bone Pieces	Carnivore Gnawed Pieces	% of Total
300N/-200E	Pit 29	21	1	4.8%
300N/-300E	Hearth 1	91	1	1.1%
400N/-300E	Pit 0	2738	10	0.4%
	Pit 146	34	2	5.9%
	Ditch[1]	686	2	0.3%
400N/-400E	Midden	1852	5	0.3%
	Pit 4	44	1	2.3%
	Pit 10	247	1	0.4%
	Pit 23[2]	1	1	100.0%
Mound	Midden	981	3	0.3%
	Fill	1097	6	0.6%
500N/-400E	Pit 4	626	1	0.2%
	Pit 14	2636	8	0.3%
	Pit 16	12	1	8.3%
	Pit 31	195	1	0.5%
	Pit 50	4	1	25.0%
	Structure 1	465	1	0.2%
	Burial 2, fill	21	1	4.8%
	Midden	1325	1	0.1%

[1]Trench 3073, 3113.
[2]Single deer tibia.

to cut down on flies and the odor of decay. It would seem that climatic conditions in the Southeast might warrant such behavior on a nearly year-round basis with the possible exception of December through February. Therefore, the proportions of faunal taxa in the two types of deposits were compared to determine if any seasonal differences in usage were apparent. No major differences were noted. Middens yielded larger quantities of turtle fragments (9 percent of the identified bone fragments) than did refuse pits (5 percent) at the expense of fish remains (2 versus 3 percent) and fragments of bird bone (7 versus 9 percent). The faunal content of the two types of refuse areas were essentially identical in other respects.

Although the reduced frequency of fish bones in sheet middens may suggest less frequent usage of these extensive deposits for refuse disposal during warm weather, the pattern probably reflects preservation differences between midden and pit deposits rather than any seasonal differences in use. Generally speaking, both fish and bird bone are quite fragile and would be incapable of enduring a great deal of mechanical abuse. Because most middens in the village were extremely shallow (10-20 cm), fragmentation due to trampling may have played a significant role in the apparent variability in content. The distribution of identifiable deer elements in pits versus middens also suggests that increased mechanical pressures may have altered the original midden assemblages. Fragile elements such as ribs and vertebrae were recognized less frequently in faunal samples from midden deposits, whereas long bone shaft fragments were more common in such deposits.

One difference noted between midden and pit deposits during analysis was the higher frequency of burned bone in middens. Fifty-eight percent of the bone fragments recovered from midden deposits were burned to some extent versus only 42 percent in pitfill. By weight, 46 percent of the bone from middens was burned compared to 26 percent in pit deposits. The intentional burning of refuse in these extensive deposits may have partially alleviated the problem of putrefaction, though this pattern also could be related to preservation.

<u>The Features: Seasonality</u>

The subsampled pits were closely scrutinized to determine if any species consistently co-occurred in the hope of refining the seasonality information inferred from the Late Woodland assemblage. This attempt proved unsuccessful. Many Mississippian features defied attempts to attribute faunal assemblages to a specific season of procurement. The major exceptions to this statement were small refuse pits yielding almost exclusively deer, bear, or both of these species. These two large mammals were procured primarily in fall and winter according to ethnohistoric sources and archaeological evidence.

Unlike the Woodland sample, fish and turtle remains never dominated faunal assemblages from Mississippian features. The most convincing example of a Mississippian pit filled with refuse generated during the summer was Pit 8 in Hectare 400N/-300E. Two seasonal "markers" were recovered from this feature: an unidentified fish vertebrae from an individual that appears to have been procured during mid-summer based on annulus formation; and an unidentified long bone from a large mammal foetus. If the foetal long bone is, in actuality, deer (which is probable), procurement probably occurred sometime between May and July. Species identified from Pit 8 include deer,

rabbit, cotton rat, turkey, mud-musk, map, and box turtles, garter or ribbon snake, bowfin, catfish, sunfish, and an unidentified viper. Although numerous species were present, the bulk of the biomass represented was large mammal (Table 17).

A more "typical" refuse pit and an example of a relatively diverse faunal sample from a feature probably filled with fall and winter refuse is Pit 10 in Hectare 400N/-400E. Identified from Pit 10 were 6 species: deer, bear, raccoon, gray fox, gray squirrel, and catfish. The faunal sample from Pit 10 is comparable in size to Pit 8 (194 gm and 158 gm respectively), yet species diversity in Pit 10 was much lower and estimated biomass contribution was almost exclusively mammalian (Table 18).

Molluscs were recovered from nearly all of the Mississippian features yielding bone, although the density was generally higher in features with relatively large quantities of fish bone. The density of mussel shell in Pit 8, for example, was 61 kg/m^3 compared to 8 kg/m^3 in Pit 10. These findings parallel the observations made regarding the seasonality of shellfish exploitation on the basis of the Late Woodland assemblage. However, it should be emphasized again that the presence or absence of mollusc remains cannot be considered conclusive evidence of the season of origin for an assemblage.

The Features: Butchering and Processing Activities

Based on fieldwork among the Nunamiut Eskimo, Lewis R. Binford (1978) has made an exhaustive study of the structure of faunal assemblages that can be expected as a result of specific butchering and processing activities. The primary (and almost exclusive) subsistence resource of the Nunamiut is caribou, a member of the same taxonomic family (Cervidae) as white-tail deer. Because Nunamiut subsistence focuses so intensively on this single large mammal, Binford described in some detail the potential subsistence utility of specific anatomical parts based on empirical studies of caribou anatomy. He outlined the specific body parts likely to be culled at kill sites by the Nunamiut, those likely to be introduced to residential areas, and the structure of assemblages resulting from the processing of meat for storage. This study is applicable to the analysis of faunal assemblages in the Southeast not only because deer and caribou are very similar anatomically, but also because some of the constraints influencing Nunamiut decisions pertaining to the treatment of meats are analogous to those operative in the subsistence system of Southeastern Indians.

Due to the migratory behavior of caribou, the Nunamiut must procure nearly all of their food for the entire year during two short hunting seasons in the spring and fall. While white-tailed deer were available in the Southeast on a year-round basis, certain advantages accrued to harvesting this species during the fall and early winter. Deer attain maximum weight during the fall, are relatively aggregated in upland areas with numerous hardwoods, are more easily seen and pursued after potentially obscuring foliage is no longer a problem, and, due to the onset of the breeding season, are less shy and easier to approach (cf. Smith 1975 for an extended discussion of aboriginal deer hunting). Furthermore, procurement of deer during fall and winter did not conflict with the labor demands of the harvest.

Smith found that at Mississippian period sites in the Central Mississippi

TABLE 17

Biomass Contribution of Taxa Recovered from Pit 8 (Hectare 400N/-300E) Based on Skeletal Mass Allometry.

	Bone Weight (g)	Estimated Biomass (kg)	Corrected Biomass (kg)	Estimated Contribution (Meat Yield)
Large Mammal	97.6	1.60	.96	63%
Small Mammal	7.6	.20	.12	8%
Bird	24.1	.40	.28	18%
Turtle	16.3	.20	.07	5%
Snake	.6	.01	.01	1%
Fish	2.86	.10	.08	5%

TABLE 18

Biomass Contribution of Taxa Recovered from Pit 10 (Hectare 400N/-400E) Based on Skeletal Mass Allometry.

	Bone Weight (g)	Estimated Biomass (kg)	Corrected Biomass (kg)	Estimated Contribution (Meat Yield)
Large Mammal	161.5	2.60	1.56	89.0%
Small Mammal	14.0	.30	.18	10.0%
Bird	0.2	.01	.01	0.5%
Fish	0.3	.01	.01	0.5%

Valley, the hunting season was largely restricted to three months -- November through January. The same is indicated by the sample of deer mandibles recovered in the Lubbub Creek Archaeological Locality. Eight of the nine deer mandibles that could be assigned season of death came from individuals procured during November, December, or January.

Because deer supplied the bulk of the animal protein consumed, the temporally restricted procurement of deer produced some logistical problems. Specifically, the meat either had to be consumed immediately to avoid spoilage or had to be prepared in a manner facilitating storage. The Nunamiut accomplish the latter by freezing or drying caribou meat. Historically, Southeastern Indians preserved venison for later consumption by drying or smoking. If venison was dried prehistorically, this activity should be apparent archaeologically in the composition of some assemblages.

Binford found that when dried meat was the objective, the major concern of the Nunamiut was with increasing the surface area of the meat per unit weight to facilitate rapid drying. This goal can be accomplished by butchering the animal into units with a high surface to mass ratio. Some of the external musculature covering the ribs, breast, and abdomen can be removed to facilitate drying, for example, and the flesh can be stripped away from the long bones. A second concern of the Nunamiut is the fat content of the meat. The greater the fat content, the less likely are the chances of adequate drying. Meat retaining too much moisture is subject to putrefaction and insect infestation because flies lay eggs in the moist folds of incompletely dried meat. Under most circumstances, the Nunamiut strategy for alleviating both of these problems is to immediately consume those parts which have high fat content or are difficult to dry due to irregular surface areas or a low surface area to mass ratio. These parts include the skull, meat adhering to the vertebral column, and the brisket. The remaining parts are processed for drying. Some cuts are dried with the bone attached, specifically the ribs, and during cool weather when insect infestation is not a problem, the brisket (sternum and costal cartilage) and the vertebral column (including the pelvis and sacrum). When warm weather is anticipated, neither the brisket nor the vertebral column is dried. Meat from the front and hind limbs is boned and dried in large flat pieces. In the case of the forelimbs, the Nunamiut leave thin strips of meat attached to the edges of the scapula. The scapula is then placed on a drying rack in a horizontal position, thus facilitating the exposure of the attached musculature to sun and air.

Parts reported to have been processed for storage by Southeastern Indians correspond well with Binford's descriptions. Swanton's (1946:374-375) interviews with two informants on this subject suggest that external thoracic and abdominal muscles were removed during butchering, and that at least among the Alabama, the rib slabs were dried (with the bone attached). Both the Creek and the Alabama informant mention stripping meat from the thighs (femur):

> First the long bones were removed, and then the meat was cut up into chunks somewhat larger than baseballs. Withes or sticks were passed through these and they were placed over a fire until nearly cooked, by which time the meat had shrunk to about the size of a baseball" (pp.374-375).

The hind limb is almost invariably processed for storage by the Nunamiut because the meat is lean and is easily detached from the bone.

It is interesting to note that in the Southeast meat was usually processed not by sun-drying, as is the case among the Nunamiut, but by "roasting". Binford (1978:91) points out that "preservation through drying is made possible by the reduction of...moisture below the point at which optimal reproduction of decomposers takes place." The decomposers referred to are the bacteria which cause meat spoilage. These bacteria are sensitive to temperature as well as moisture. The reproductive rates of Bacillus mycoides, for example, are highest between ca. 16 and 37 degrees C (ca. 60-98 degrees F), but cell division stops at temperatures above 39 degrees C (normal body temperature for most warm-blooded animals) and below 6 degrees C (42 degrees F) (Binford 1978:92). Therefore, in areas such as central Alabama that occasionally experience high ambient temperatures during the winter, dessication would need to be extreme to insure preservation. Swanton states that meat preserved in this manner "would keep for an entire year. If it had not been dried sufficiently, screw-worms would breed in it" (1946:375).

Based on Binford's observations and the ethnohistorical information cited above, discard assemblages resulting from the processing of venison for storage might be expected to contain large numbers of long bones (particularly those of the rear limb) and very few or no ribs. These expectations are based on two assumptions: first, that the long bones would have been discarded soon after the muscle tissue was removed for drying; and second, that the rib slabs were dried with the bone attached. In addition, if the scapula were used in a manner similar to that observed for the Nunamiut, it should be absent from the assemblages.

Detecting such assemblages in faunal samples from the Mississippian village under consideration here is complicated due to the fact that this village was the location of many activities unrelated to processing meat for storage. Because this site is not a specialized processing encampment, interpretation of the skeletal elements contained in any feature depends on the location of the pit in relation to other village activities, i.e., whether the refuse pit was located in a specialized processing area or was used in addition for refuse resulting from other cooking and consumption activities. If the latter were true, parts that would have been consumed immediately, such as the head (skull), meat adhering to the vertebrae, and the brisket (sternebrae and costal cartilage), might be expected in the assemblage. This possibility is clearly related to the length of time a refuse area was used for discard. If used for an extended period of time, any "signature" assemblage would eventually be obscured. Therefore, the subsampled pits[7] were examined for assemblages with low species diversity and, of necessity, high deer or large mammal content (>90 percent by weight of identified bone), both of which were presumed to indicate short term usage. The third criterion used to detect possible "processing pits" was large numbers of identified long bone fragments. In order to avoid biasing the results, no stipulations were made regarding the kinds of elements represented, nor were features scrutinized for low frequencies of rib fragments. The four features meeting

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[7]Middens were excluded from this analysis because they were not excavated in their entirety.

these general criteria were Pit 23 in Hectare 300N/-300E, Pit 1 and Pit 47 in Hectare 500N/-300E, and Pit 4 in Hectare 500N/-400E. Excluding Pit 23, which could not be assigned to a cultural period on the basis of ceramic content, all of these features date to the mature Mississippian period (Summerville II-III). The elements recovered from these four refuse pits are shown in Table 19. Minimum numbers of individuals was calculated by dividing the number of unique elements occurring in each pit by the number expected in an anatomically complete individual as suggested by Binford (1978:69-72). Percentages were calculated by dividing MNI by the most frequently occurring element. Because the actual volume of bone recovered from each feature was highly variable, the weight of identified bone per feature is included in the table.

Several patterns are evident in these data: 1) both the front limb and the hind limb are represented in each pit, but the latter is more common; 2) mandibles are consistently present; 3) ribs are rare or absent; and 4) bones of the lower leg (metapodials and phalanges) are not present or are present in very low frequencies.

In the three larger samples, the thigh (pelvis or femur)[8] is the most common body part represented, as should be expected, given the ease with which this part can be boned and dried. However, the consistent occurrence of front limbs in these pits suggests that meat from the forequarters was dried as well, though probably not as frequently as that from the hindquarters. Since scapulae are present in two of the four features, these bones probably were not used in a manner similar to that of the Nunamiut. The latter is not unexpected since most of the meat was probably smoked rather than sun dried.

The occurrence of mandibles in each of these features was not anticipated. The Nunamiut prefer to consume the tongue of caribou while it is fresh. However, according to Romans (in Swanton 1946:285), the Cherokee dried "the tongues of their venison." The consistent association of mandibles with what appears to be processing refuse strongly suggests that the tongue was dried, although the tongue may have been consumed while the other meat was being processed.

Ribs, when present, occurred in low frequencies as would be expected if they were dried with the bone included. However, the reader should recall that ribs, and the axial skeleton in general, were grossly underrepresented in the assemblage as a whole. Therefore, the paucity of ribs in these features may not be significant. Binford (1978:152) has suggested that one means of distinguishing ribs that were dried from those consumed while fresh is the degree of fragmentation. The Nunamiut are careful not to break dried ribs because the marrow is invariably rotten. If this criterion is applicable to the consumption practices of Southeastern Indians, most of the ribs recovered from these features were consumed while fresh. All of the rib fragments were less than 10 cm (4 inches) in length. However, no means are available to evaluate predepositional breakage unrelated to consumption. In the case of Pit 4, which appears to have been used for a fairly extended period of time (perhaps for several months), the ribs in the assemblage may have been dried

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[8]As previously discussed, the acetabulum (pelvis) and femur appear to have been butchered as a unit.

TABLE 19

Deer Elements Recovered from "Processing Pits"

	HA 300N/-300E Pit 23		HA 500N/-300E Pit 1		HA 500N/-300E Pit 47		HA 500N/-400E Pit 4	
	MNI	%	MNI	%	MNI	%	MNI	%
Skull	0.0		0.50	50%	0.0		1.0	29%
Mandible	0.5	100%	1.00	100%	0.5	25%	1.0	29%
Atlas	0.0		0.00		0.0		0.0	
Axis	0.0		0.00		0.0		2.0	57%
Cervical Vert	0.0		0.00		0.0		0.2	6%
Thoracic Vert.	0.0		0.08	8%	0.0		0.9	26%
Lumbar Vert.	0.0		0.00		0.0		0.6	17%
Ribs	0.0		0.04	4%	0.0		0.3	9%
Sternum	0.0		0.04	4%	0.0		0.2	6%
Scapula	0.5	100%	0.00		0.0		2.0	57%
Humerus	0.0		0.50	50%	1.0	50%	1.0	29%
Radius	0.0		0.00		1.5	75%	1.0	29%
Carpals	0.0		0.00		0.0		0.2	6%
Metacarpal	0.0		0.00		0.0		0.5	14%
Pelvis	0.5	100%	0.00		0.5	25%	3.5	100%
Femur	0.0		1.00	100%	2.0	100%	2.0	57%
Tibia	0.0		0.50	50%	1.0	50%	1.0	29%
Metatarsal	0.0		0.00		0.0		0.5	14%
Tarsals	0.0		0.34	34%	0.0		0.2	6%
Astragalus	0.0		0.50	50%	0.0		0.0	
Calcaneus	0.0		0.00		0.0		0.0	
Phalanx 1	0.0		0.00		0.0		0.1	3%
Phalanx 2	0.0		0.00		0.0		0.0	
Phalanx 3	0.0		0.00		0.0		0.0	
Total Identified Bone (g)	68.3		138.4		204.4		883.8	
Deer and Large Mammal (g)	64.6	(95%)	135.7	(98%)	203.7	(100%)	813.6	(92%)
Large Mammal Indet. (g)	6.4	(9%)	10.9	(8%)	9.5	(5%)	26.7	(3%)
Large Mammal, Long Bone (g)	17.3	(25%)	33.4	(25%)	37.8	(19%)	223.1	(27%)

initially and introduced to the pit at a later date.

The final feature common to all four assemblages is the marked paucity of bone of the lower legs, which suggests that the carcasses were introduced to the village area for processing only after the initial butchering had taken place. One feature, a midden in Hectare 500N/-400E (USN 4316), clearly indicates that some of the primary butchering occurred on the outskirts of the village. This shell midden was encountered outside the bastioned palisade surrounding the village, although it is unclear if the midden was contemporary with the fortification. In any case, the midden is spatially removed from the habitation area and produced an assemblage strongly suggestive of primary butchering. Skull fragments and bones of the feet and lower legs were extremely common (Table 20). The complementary nature of the body parts present in this midden and in Pit 4 is shown graphically in Figure 5. The differences between these two features suggest that caution should be exercised in the interpretation of either site function or field dressing based on faunal remains from a single area.

Although the interpretations offered for the composition of the features described above are tentative, if they are correct, it can be concluded that some deer processing occurred within the confines of the village during the Summerville II-III period. The anatomical parts which appear to have been dried include meat from the hindquarters and to a lesser extent the forequarters, and probably the tongue. Whether or not ribs slabs were dried cannot be resolved at this time because the evidence is, at best, ambiguous.

Processing venison for storage does appear to have been a response to the logistical problems created by harvesting deer during a restricted period of time. It was possible to age three of the deer mandibles from these "processing pits," and two were seasonally diagnostic. Both of the seasonally diagnostic mandibles (from Pit 47 and Pit 4) were from individuals estimated to have been between 15 and 16 months of age at death.* These ages suggest that deer were processed for storage during late fall (November-December), the season during which deer were harvested most intensively.

II. Subsistence

Although 77 species were identified from Mississippian features at the Lubbub Creek Archaeological Locality, only a few were of economic importance as subsistence items. As is true of many faunal assemblages from prehistoric sites in the Southeast, white-tail deer and wild turkey dominated the faunal sample from this Mississippian village. These two species contributed 54 percent of all bone fragments identified to family, genus, or species. Most of the meat, however, was supplied by deer. Counts, weights, and minimum numbers of individuals, calculated by temporal subdivisions, are shown in Appendix B for each taxa. The size of the faunal sample which could be attributed to the Summerville I occupation is very small in comparison to samples from subsequent occupations of the village, yet relative biomass contribution (calculated by bone weight) of each taxonomic class remained consistent throughout the Mississippian period. By weight, mammals

*The remaining relatively complete mandible (from Pit 1) was from an individual approximately 3 years of age.

TABLE 20

Deer Elements Recovered from Shell Concentration in Hectare 500N/-400E.

	MNI	%
Skull	3.5	100.0%
Mandible	1.0	29%
Atlas	1.0	29%
Axis	0.0	
Cervical vert.	0.1	3%
Thoracic vert.	0.0	
Lumbar vert.	0.2	6%
Ribs	0.2	6%
Sternum	0.0	
Scapula	0.5	14%
Humerus	0.5	14%
Radius	0.5	14%
Carpal	0.5	14%
Metacarpal	1.0	29%
Pelvis	0.5	14%
Femur	0.5	14%
Tibia	0.5	14%
Metatarsal	2.0	57%
Tarsals	0.2	6%
Astragalus	0.0	
Calcaneus	1.0	29%
Phalanx 1	1.4	40%
Phalanx 2	1.0	29%
Phalanx 3	0.6	17%
Total Identified Bone (g)	826.4	
Deer and Large Mammal (g)	642.6	(78%)
Large Mammal Indet. (g)	65.4	(10%)
Large Mammal, Long Bone (g)	283.8	(44%)

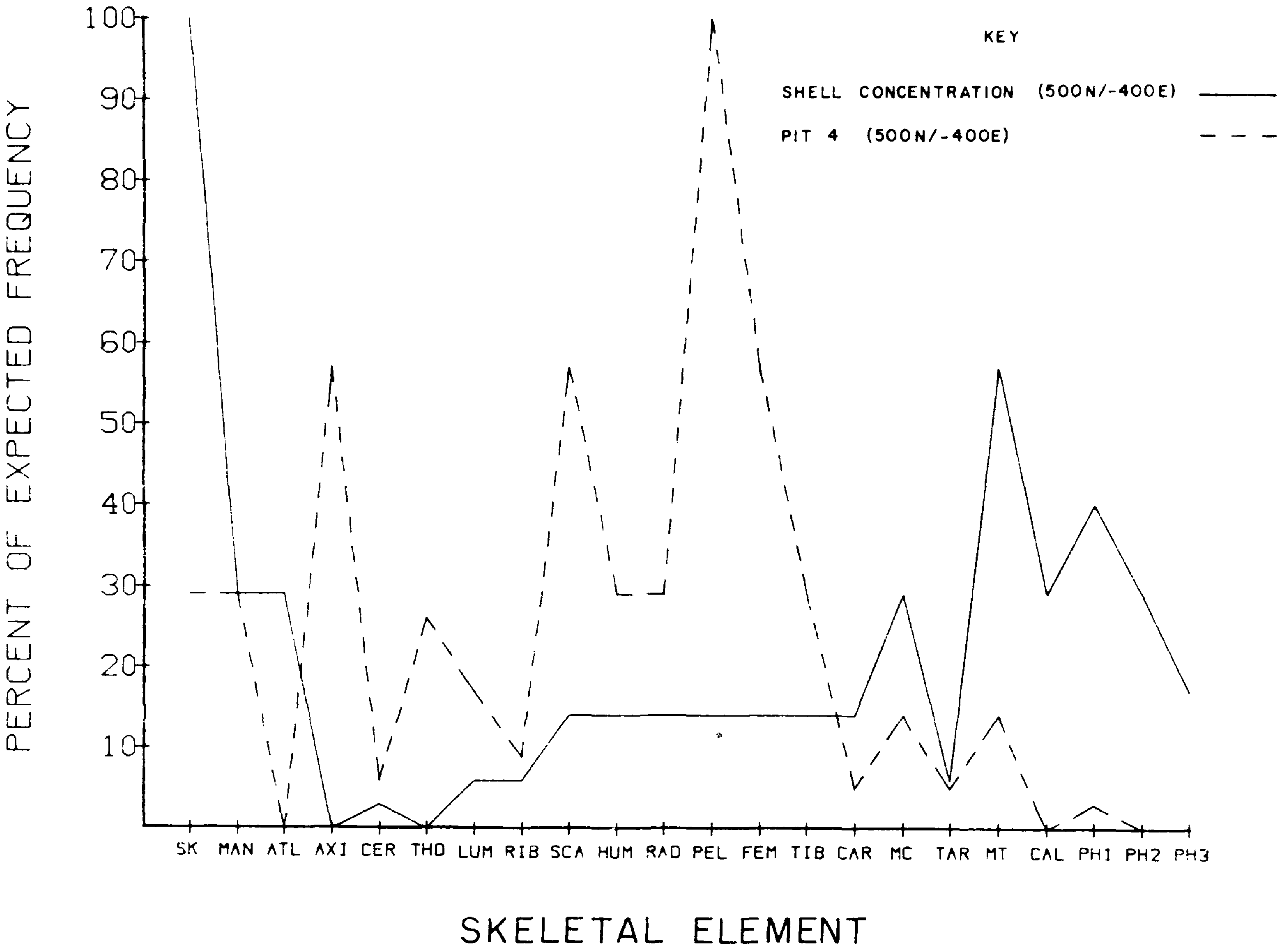

Figure 5. Deer and large mammal elements recovered from a primary butchering area (shell concentration) and a processing for storage area (Pit 4).

contributed between 87.5 and 89.1 percent of the identified bone, birds, 6.2 to 7.7 percent, turtles, 3.7 to 4.7 percent, and all other classes combined contributed 1 percent or less. The consistency in these proportions suggests a great deal of stability in the exploitation of animal populations throughout the Mississippian period at this site. None of the trends are of sufficient magnitude to postulate increased or decreased emphasis on any taxa through time.

It should be pointed out that the MNI values presented in Appendix B are subject to numerous sources of bias. Very common species such as deer and rabbits are probably underrepresented, and reptiles are not comparable to mammalian and avian fauna. As mentioned previously, MNI for fish remains was calculated by feature and, therefore, is not directly comparable to minimum number values for other taxa in Appendix B. These figures are presented because at most sites, MNI is calculated in like manner. Therefore, these values may be of some utility to researchers having few reservations about the validity of this quantitative technique or to those forced to combine their samples in this manner due to a lack of other alternatives.

An alternative to this method of aggregation was available for the present sample. In order to determine the relative importance of taxa, it was decided to calculate minimum numbers in a manner which, in my opinion, probably more accurately reflects relative abundance. The basis for this calculation was the remains from the subsample of pits, middens, mound construction stages, and walltrenches listed in the introductory portion of this section (see Table 15). MNI values were calculated by feature, or, in the case of deer and bear, by clusters of features, since it seemed likely the remains of these large mammals might have been deposited in more than one refuse pit. Cultural affiliation and presumed season of deposition were taken into account in this combination of assemblages so that large mammal remains from early and late Mississippian or winter and summer features were not counted as single individuals. The calculation of minimum numbers in this manner allowed the inclusion of faunal samples from Mississippian features that proved impossible to attribute to a specific cultural period on the basis of the ceramic chronology developed for the site.

Although the possibility exists that the remains of a single animal may have been tabulated more frequently than warranted by virtue of portions of the animal being distributed to friends, political superiors, or relations (and eventually discarded in a number of spatially discrete areas), the skewing is probably minor compared to the skewing of the figures shown in Appendix B. The MNI values obtained for turtles, snakes, amphibians, and fishes are relatively comparable to the values for mammals and birds, for example. Some slight underrepresentation of very common species may still be present, however, as a result of values obtained from very large samples such as the faunal assemblages from Pit 14 (Hectare 500N/-400E) and Pit 0 (Hectare [illegible]N/-30[illegible]).

The resulting MNI values per taxon and estimated meat contributions are [illegible] materials for average live-weight per taxon and [illegible] included. Proportions of edible meat for [illegible] were [illegible] White (1953) unless indicated otherwise.

The average live weight for deer was calculated on the basis of the age

TABLE 25

Average Weight of Large Mammal and Deer Fragments in Mound and Village Deposits.

	Pieces	Weight (g)	Avg. Weight g/Piece
Mound			
Skull	59	285.0	4.8
Axial Skeleton	97	282.5	2.9
Front Limb	39	655.1	16.8
Rear Limb	44	667.9	15.2
Lower Limbs/Feet	63	170.2	2.7
Long Bone Fragments	684	527.0	0.8
Indet. Fragments	203	101.9	0.5
Village			
Skull	754	1195.4	1.6
Axial Skeleton	495	1062.3	2.2
Front Limb	136	1381.0	10.2
Rear Limb	154	2013.0	13.1
Lower Limbs/Feet	487	1177.6	2.4
Long Bone Fragments	[illegible]	4132.1	0.5
Indet. Fragments	2045	[illegible]	0.5

TABLE 24

Comparison of Species Abundance in Mound and Village Deposits

Species	Village			Mound		
	Observed MNI[1]	Expected MNI[2]	Difference[3]	Observed MNI[1]	Expected MNI[2]	Difference[3]
MAMMALS						
Opossum	5	5.5	-0.5	2	1.5	+0.5
Raccoon	6	6.0	0.0	2	2.0	0.0
Skunk	[illegible]	2.0	0.0	1	1.0	0.0
Bobcat	[illegible]	2.0	-1.0	2	1.0	+1.0
Squirrel	22	23.0	-1.0	8	7.0	+1.0
Beaver	2	4.0	-2.0	3	1.0	+2.0
Rabbit	26	25.0	+1.0	6	7.0	-1.0
Deer	49	44.0	+5.0	8	13.0	-5.0
BIRDS						
Turkey	11	10.0	+1.0	8	9.0	-1.0
Other	9	10.0	-1.0	9	8.0	+1.0
TURTLES						
Snapping	3	4.5	-1.5	3	1.5	+1.5
Mud-musk	8	7.5	+0.5	2	1.5	-0.5
Sliders Cooters Map	18	17.0	+1.0	5	6.0	1.0
Chicken	2	2.0	0.0	1	1.0	0.0
Box	12	11.0	+1.0	3	4.0	1.0
Softshell	14	14.0	0.0	5	5.0	0.0
SNAKES						
Non-poisonous	16	16.0	0.0	5	5.0	0.0
Poisonous	5	5.0	0.0	2	2.0	0.0
FISHES						
Bowfin	11	[illegible]	+2.0	3	5.0	-2.0
Gar	[illegible]	9.0	0.0	4	4.0	0.0
Suckers	[illegible]	8.0	+2.0	2	4.0	-2.0
Catfish	[illegible]	[illegible]	-3.0	17	14.0	+3.0
Sunfish	[illegible]	13.0	-2.0	8	6.0	+2.0
Drum	[illegible]	[illegible]	+1.0	8	9.0	-1.0

[1]Calculated by feature using subsampled features listed in Table 15
[2]Expected values calculated within each taxonomic class or suborder using chi square.
[3]Rounded to the nearest whole digit, or tenth (0.5)

29 percent (26 91) in the village. Deer were not as common as expected, although this could be the result of butchering activities occurring in the village or elsewhere with boned meat being brought back to the mound area. Deer feet (phalanges, sesamoids, dew claws) were less frequently encountered in mound samples than in village refuse (6.6 percent versus 16 percent of all fragments identified as deer). Numerous other species were slightly underrepresented in the mound -- rabbits, turkey, mud-musk and box turtles, cooter/slider/map turtles, bowfin, suckers, and drum. A pronounced skewing in the distribution of rabbits on the site was apparent, with swamp rabbits, the larger of two species, much more common in the mound refuse (2 of 3 individuals) than in village deposits (3 of 14 individuals).

Evaluation of the patterns of scarcity and abundance of species in the mound deposits is difficult since most of the observed differences between mound and village deposits are not of great magnitude (cf. Table 23). The differential distribution of some species across the site could be the result of sampling error because the faunal assemblages were of disparate size. However, other differences could have resulted from the conscious selection of certain animals according to the nutritional needs or taste preferences of an individual(s), the size of the animal, or the prestige accrued a species difficult or dangerous to capture. Many of the species that were overrepresented in the mound sample are judged by Western standards to be highly desirable and palatable subsistence items (e.g., snapping turtles and catfish). Based on nutritional assays published in Watt and Merrill (1963), the species of fish (for which data are available) that are overrepresented in the mound are those with high protein rather than high fat content -- a reaction, perhaps, to a diet very high in carbohydrates.

The relative abundance of deer elements in mound and village deposits was compared to determine if there was any evidence that anatomical parts were differentially distributed in the two areas. Research of a similar nature at the Mississippian site of Toqua in Tennessee led Bogan (1980) to postulate that the "preferred" cuts of meat included the forelimbs and the axial skeleton. Both parts were relatively more abundant (based on fragment counts) in faunal samples from Mound A at Toqua and a portion of the village interpreted as a high status residential area.

Some problems were encountered in comparing these two samples from the Lubbub Creek Archaeological locality. It was apparent during analysis that bone from the village area was much more extensively fractured, a result perhaps related to different consumption practices but no doubt influenced by differing amounts of human traffic. Average weight per piece was consistently higher in mound deposits for all parts of the deer skeleton (Table 25). For this reason, comparing counts of elements would be misleading. Therefore, the weight of the bone from the skull, axial skeleton, front limb, hind limb, and feet (carpals, tarsals to phalanges) were compared for the two areas using the proportions by weight of these parts in a comparative specimen as a standard (Table 26). Fragments identifiable as to body part (e.g., vertebrae) but [illegible] identifiable [illegible] large mammal were included to further correct for any differences [illegible] of bone in the two areas. Most of these [illegible] fragments [illegible] have been identified as deer had they [illegible].

With some exceptions [illegible] between the proportions of these

TABLE 23

Weight of Faunal Taxa in Mound and Village Deposits.

	Mound		Village		Total Site
	Weight (g)	% of Total Site	Weight (g)	% of Total Site	
Large Mammal	2,366.50	16.0	12,389.80	84.0	14,75[illegible]
Small Mammal	96.60	14.5	571.80	85.5	66[illegible]
Bird	196.15	16.8	973.65	83.2	116[illegible]
Turtle	120.63	19.0	514.37	81.0	635.[illegible]
Snake	2.20	9.8	20.20	90.2	[illegible]
Amphibian	0.50	17.8	2.31	82.2	2.8[illegible]
Fish	40.85	31.2	89.98	68.8	[illegible]
Total	2,823.43	16.2	14,562.11	83.8	17,[illegible]

themselves to black cloth" (Swanton 1931:44). The inclusion of this species in the sand fill suggests a possible impetus for the periodic accretion of the mound.

Five birds -- wild turkey, cardinal, mockingbird/brown thrasher, green heron (<u>Butorides virescens</u>), and passenger pigeon (<u>Ectopistes migratorius</u>) -- were identified from a sample of the fourth clay cap (USN 4533) overlying the deposit yielding the crow. Collectively, these species would have provided red, black, gray, white, green, and lavender feathers for the decoration of some article of clothing or ritual paraphenalia. The association of these birds in a single deposit could be coincidental, but it is interesting to note that the four colors used by the Cherokee to symbolize the cardinal directions (red, black, white, blue/purple) are all represented in this sample. Several of these species were undoubtedly subsistence items. Wild turkeys were certainly eaten on a regular basis, and it is probable that green herons and passenger pigeons were not uncommon food items. A pigeon roost was located less than 70 km away near what is now Philadelphia, Mississippi (Swanton 1946:Map 13), and the green heron was referred to in Alabama as "Indian hen" through the early part of this century (Howell 1928). These three species were recovered from refuse deposits in the village also. However, both of the passerine species were unique to the mound and undoubtedly were not common dietary items. The same is true of a bluejay and a Merlin (pigeon hawk) recovered from disturbed mound fill.

Other than the occurrence of these birds, the major difference between the faunal assemblage from the mound area and refuse from the village was a much higher quantity of fish remains in mound deposits (Table 23). Although the faunal sample from the mound contributed only 16 percent by weight of the entire Mississippian assemblage, 31 percent by weight of all fish bone was recovered from this area of the site. Nearly all (97 percent) of the fish recovered in the mound area came from two deposits, the midden and the fourth clay cap, both of which yielded unusual birds. Turtle bone was also more common than expected in the mound (19 percent by weight), but snakes were relatively rare (10 percent by weight).

The higher than expected quantities of both fish and turtles could be interpreted as a seasonal phenomenon in which village-wide ritual or ceremonial activities centered on (or near) the mound occurred with greater frequency during the spring or summer months. However, given the relative paucity of fish remains in most Mississippian refuse pits and the somewhat unimportant role played by this taxonomic class in estimates of the relative importance of subsistence resources, the observed concentration of fish bone in the mound could also be the result of differential selection of subsistence items by a person having some control over the allocation of resources. It is interesting to note in this regard that "a fish diet was thought highly of by the ancient Choctaw", according to Swanton (1931:55).

As can be seen in Table 24, some degree of selection may also have been exercised in the kinds of fish and other animals remaining in the mound area. Based on MNI tabulated by feature or deposit, species more common in mound deposits than would be expected if species abundance were uniform across the site include opossum, bobcat, squirrels, beaver, snapping turtles, catfish, and sunfish. Catfish, in particular, were very abundant, contributing 40 percent (17/42) of the individual fish represented in the mound, as opposed to

faunal [illegible] mound and village deposits was compared to determine if any differences in subsistence practices was apparent.

Interpretation of the probable source of faunal refuse recovered from the mound area was complicated because m[illegible]is architectural feature was destroyed for agricultural purposes in the 1950s (See Blitz, Chapter 7, Volume 1). Only the premound structures and the basal portion of at least four mound building episodes remained intact. The upper portion of the mound had been completely destroyed and distributed over an area greater than a hectare in extent. The largest samples of animal bone in undisturbed context came from a midden located adjacent to the ramp on the south side of the mound and from samples taken from midden debris incorporated into specific construction stages on the west side of the mound. In both cases, Blitz interpreted these deposits as probably having originated on the mound. Additional faunal samples were analyzed from the disturbed mound fill, excluding those containing historic materials.

The presence of three species of colorfully plumed birds in mound deposits supports Blitz's interpretation that the refuse found in this area was generated nearby, since no comparable species were recovered from village refuse deposits.[12] In all, six species of birds were recovered from mound deposits which are more likely to have contributed feathers or skins for ritual occasions than meat. They include Carolina parakeet (*Conuropsis carolinensis*), cardinal (*Cardinalis cardinalis*), bluejay (*Cyanocitta cristata*), crow (*Corvus brachyrynchos*), mockingbird/brown thrasher (Mimidae),[13] and a Merlin (*Falco* cf. *columbarius*).[14]

Carolina parakeets, extinct since 1914 (Guilday 1971), were bright green birds with yellow plumage on the head and wing. This species was quite common in the Southeast, though it disappeared from Alabama prior to 1880 (Howell 1928:155). Parmalee (1958; 1967) identified nine parakeet bills from a single refuse pit at Cahokia, and another archaeological specimen was recovered from a seventeenth century village in West Virginia (Guilday 1971). The single element identified as this species, a carpometacarpus, was found in the midden on the south side of the mound.

Remains of a crow were recovered from the sand fill of the fourth building stage (USN 4534). Blitz interprets the layers of sand fill as building stages, with superimposed clay strata lending stability to the final shape of the mound and serving as the surface upon which structures were erected. Among the Choctaw, "Crow feathers indicated mourning and were the only ones that could be put on when there had been a death in the family. It was principally the chiefs who used them, however, the others confining

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[12]One unusual bird, a kingfisher, was recovered from the village on the floor of Structure 5 in Hectare 400N/-300E. The flesh of this species may have been used to protect clothing from moths (cf. Swanton 1946:444).

[13]The element identified to this family was too large to have been from a catbird.

[14]*Falco sparverius* is the other possibility, though the archaeological specimen was larger than the available comparative material for this species.

energies in procuring three major (animal) species groups: 1) fish; 2) migratory waterfowl; and 3) terrestrial species such as deer, raccoon, and turkey. This proposition was based on samples of faunal remains from seven Mississippian sites located on the floodplain of the Mississippi River in an area with far greater aquatic resource potential than is found in or on the banks of the Tombigbee River.

Three of the five animal resources explicitly mentioned by Smith are relatively uncommon in this assemblage (see Appendix B and Table 21). All of the aquatic, semiaquatic, and bottomland species -- fish, migratory waterfowl, and raccoons -- that appear to have been pivotal resources at sites on the Mississippi River, contribute an insignificant proportion of the animal biomass recovered from the Mississippian sample at the Lubbub Creek Archaeological Locality. By way of contrast, Smith found that at some sites on the Mississippi River at least 50 percent of the harvested biomass was made up of fish and waterfowl collectively; among the Mississippian communities in the Lubbub Creek Archaeological Locality, these two resources contributed far less than 10 percent of the animal protein consumed. Migratory waterfowl are extremely rare in this sample, reflecting the fact that the site is located in an area peripheral to both the Mississippi and Atlantic flyways (Bennett 1938), a factor recognized by Smith (1978:486) as potentially contributing to some variability in Mississippian faunal assemblages. The minor contributions made by the two other resources mentioned by Smith, fish and raccoons, probably mirror to a great extent the reduced quantities of these resources available in the natural environment due to the differences in magnitude between the Mississippi River and associated floodplain and the Tombigbee River system.

III. Spatial Variability in Subsistence Remains

Based on ethnohistoric data, it has long been assumed that the pyramidal mounds occurring on many large Mississippian sites served as substructures for buildings used for ceremonial purposes, and in some cases may also have functioned as the residence of high ranking individuals. If the mound in this village functioned in the latter capacity, some differences in subsistence remains might be apparent between the mound and the remainder of the village, given the role played by these persons in the allocation of various resources.

Historically in the Southeast, highly ranked individuals appear to have exercised some power in the distribution of subsistence items, including animal resources. In the seventeenth century, for example, Calderon (in Swanton 1946:379) reported that successful Timucuan hunters returned their game to "the principic cacique, in order that he shall divide it, he keeping the skins that fall to his share." LePage du Pratz observed that the Natchez, after a successful communal hunt, "cut the deer open and bring it back in quarters to the cabin of the great sun, who distributes it to the leaders of the hunting band" (*ibid*:320).

Given these statements, it would appear that a certain degree of choice was accorded these individuals in the resources remaining at their disposal as opposed to those returned to the populace at large. If such a system was operative prehistorically, one archaeological expectation is that species or cuts of meat considered highly desirable, or "choice", should occur in higher frequencies in the mound area. Therefore, the proportion of the various

TABLE 22

Comparison of Biomass (Live Weight) Contributions as Calculated Using *Bone* Weight, Skeletal Mass Allometry, and Minimum Numbers of Individuals

Taxa	% Based on Bone Weight	% Based on Skeletal Mass Allometry	% Based on MNI[1]
Large Mammal	85.0	86.0	82.0
Small Mammal	4.0	5.0	6.0
Bird	7.0	7.0	3.0
Turtle	4.0	1.0	2.0
Snake	0.1	0.3	2.0
Fish	1.0	1.0	5.0

[1]MNI shown in Table 21.

In contrast to the Chickasaw, the Choctaw are accused of exercising little restraint in culinary habits. Snakes were a significant resource according to these data and are explicitly mention[illegible] items among the Choctaw. Swanton (1946:289) reports that they

> ...were less dependent on animal foods than most of their neighbors and such as they had differed little. They included deer, bear, and when opportunity offered, the bison and elk. They made more use than other peoples of small animals, particularly squirrels. Fish played a smaller part in their dietary. On occasion they are said to have resorted to snakes and in later times horse meat and pork.

When detailed analyses of faunal assemblages from other late Mississippian sites in Alabama and surrounding states are available for comparison, these statements can be fully evaluated. Preliminary analysis of faunal remains from early Mississippian context at Moundville (Michals 1980) and the analysis of faunal remains from two Mississippian sites in Tennessee (Bogan 1980) suggest that snake utilization may have been a regional phenomenon.

Results of the three quantitative methods used to assess the relative importance of taxa as subsistence items are compared in Table 22. Slightly different results are obtained with each method, but the range of variability in the percentage contribution to subsistence never exceeds 4 percent per taxon. The minor inconsistencies in these results are of some value because they allow the recognition of inaccuracies inherent to each quantitative method. Bird biomass, for example, is undoubtedly underrepresented for this sample when minimum numbers of individuals is used to assess biomass contribution. This underrepresentation stems from the degree of difficulty encountered in making positive taxonomic assignments based on the osteological remains. Relatively undamaged articular ends of skeletal elements -- rare occurrences archaeologically -- are required for most bird identifications. Since minimum numbers relies on bone identified to the family, genus, or species level, the percentage contribution obtained using this method should be revised upwards for this class. The importance of fish is also probably slightly exaggerated using minimum numbers since size was not a factor considered in the calculation of minimum numbers for any other taxa. The relative importance of snakes, however, is probably more accurately reflected using minimum numbers than by either of the methods predicated on bone weight. Most snake vertebrae are so small that they readily pass through quarter-inch mesh. The cumulative effects of this differential recovery on total bone weight could be considerable -- a factor also true for fish remains. Therefore, both snakes and fish were probably of somewhat greater importance than is reflected by either gross bone weight or the biomass estimates derived using skeletal mass allometry. The final inconsistency that requires mention is the undoubtedly gross underrepresentation of turtle biomass obtained using skeletal mass allometry. The correlation achieved between skeletal weight and live weight for this suborder in empirical studies was very low (+.55, refer to Table 2) and probably is not exceptionally reliable. Regardless of these problems, however, it is noteworthy that the results of each method did not differ radically, suggesting some general degree of accuracy was attained by each.

The results of this analysis are somewhat at odds with Bruce Smith's (1978:483) proposition that Mississippian populations concentrated their

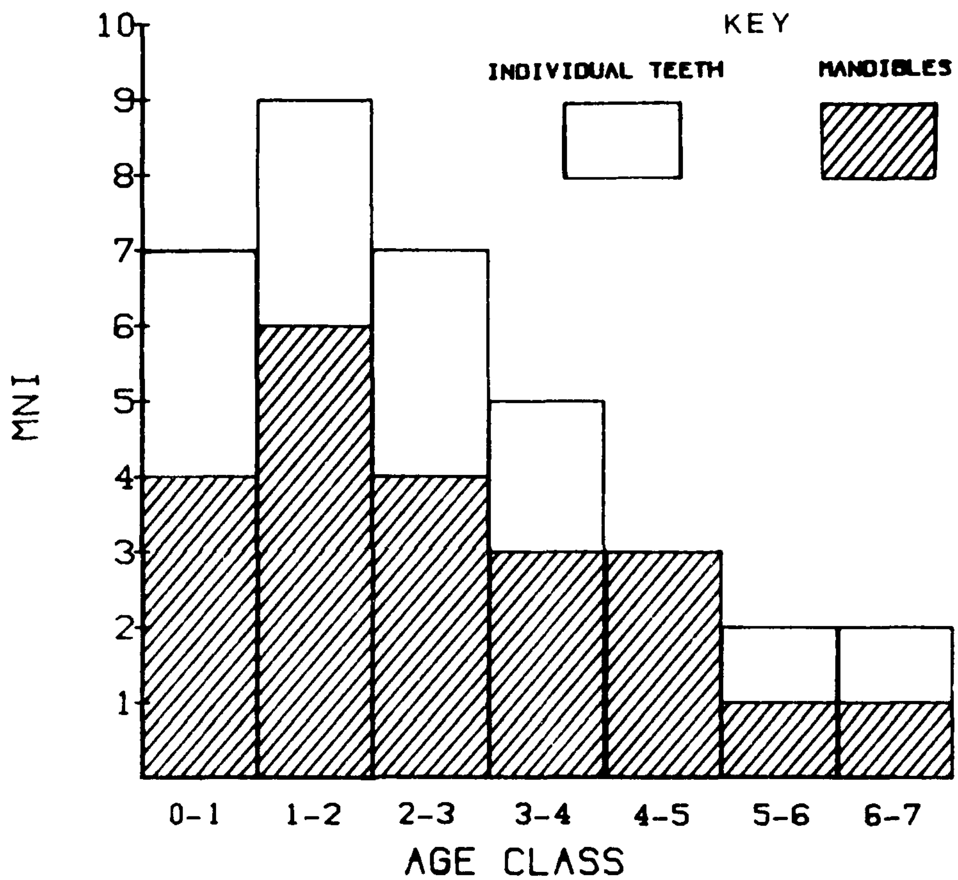

Figure 6. Age structure of the exploited deer population.

TABLE 21 (continued)

Identification	MNI	Est. Live Weight (collectively) (kg)	Total Meat Yield (kg)	Sources and Comments
Gar	4	4.88	3.4	(13)
Longnose gar	4	9.56	6.7	(13)
Spotted gar	1	32	.2	(13)
Alligator gar	2	34.08	23.9	(13)
Bowfin	17	25.27	20.2	(14)
Sucker family	4	2.02	1.6	(14)
Redhorse	8	10.71	8.6	(14)
Smallmouth buffalo	1	.91	.7	(14)
Catfish family	10	6.12	4.9	(14)
Bullhead	2	13	.1	(14)
Channel catfish	10	8.67	6.9	(14)
Blue catfish	3	5.45	4.4	(14)
Channel/Blue catfish	8	16.27	13.0	(14)
Flathead catfish	4	12.51	10.0	(14)
Madtom	3	.30	.2	(14)
Sunfish	5	2.67	2.1	(14)
Bass	9	5.06	4.1	(14)
Sunfish/Bluegill	4	.44	.4	(14)
Crappie	2	.98	.8	(14)
Freshwater drum	30	28.06	22.5	(14)
Total Fish		174.61	134.7	

Key

(1) Golley (1962)
(2) Johnson (1969)
(3) Lowery (1974)
(4) Smith (1975)
(5) Davis (1978)
(6) Based on weight data for specimens in the Bird Division, UMMZ.
(7) White (1953)
(8) Unpublished data made available by Gary Breitenbach, Herpetology Division, UMMZ.
(9) Clark and Southall (1920)
(10) Reidhead (1976)
(11) Cleland (1966)
(12) Conservative estimates based on size of skeletal elements.
(13) Carlander (1952; 1969; 1977). Estimated meat yield assumed to be .70 based on body morphology.
(14) Carlander (1952; 1969; 1977). Estimated meat yield assumed to be .80 based on body morphology.

TABLE 21 (continued)

Identification	MNI	Est. Live Weight per Individual (kg)	Total Meat Yield (kg)	Sources and Comments
Snapping turtle	5	7.20	15.5	(8) Usable meat= .43 (9)
Alligator snapper	1	45.50	19.6	Weight based on element size Usable meat= .43 (9)
Mud-musk turtle	10	0.30	0.9	(8) Usable meat= .30 (10)
Sliders/Cooters	5	1.50	2.3	(8) (10)
River cooter	3	2.00	1.8	(8) (10)
Painted turtle	1	0.30	0.1	(8) (10)
Slider/Cooter/Map turtle	12	1.60	5.8	(8) (10)
Map turtle	2	1.50	0.9	(8) (10)
Chicken turtle	3	1.00	0.9	(8) (10)
Box turtle	15	0.30	1.4	(8) (10)
Softshell turtle	19	3.00	11.4	(8) Usable meat= .20 (11)
Total Turtle			60.6	
Non poisonous snake	6	1.00	4.8	(12) Usable meat= 80
Garter/Ribbon snakes	1	0.50	0.4	(12)
Black racer	4	2.00	6.4	(12)
Coachwhip	2	1.00	1.6	(12)
Racer/Coachwhip	1	1.00	0.8	(12)
King/Milk snakes	1	2.00	1.6	(12)
Rat snakes	1	2.00	1.6	(12)
King/Milk/Rat snakes	4	2.00	6.4	(12)
Mud snake	1	2.00	1.6	
Poisonous snake	4	3.00	9.6	
Copperhead/Cottonmouth	1	3.00	2.4	
Rattlesnake	2	4.00	6.4	
Total Snake			43.6	
Frog/Toad	6	0.50	2.4	(12)
Amphibian	2	1.00	1.6	(12)
Total Amphibian			4.0	

TABLE 21

MNI and Estimated Meat Yields Per Taxa Based on Subsampled Mississippian Features

Identification	MNI	Est. Live Weight per Individual (kg)	Total Meat Yield (kg)	Sources and Comments
Opossum	7	2.00	9.8	(1)
Bear	6	113.60	477.1	(1)
Raccoon	8	3.70	20.7	(2)
Mink	1	1.00	0.7	(1)
Skunk	3	1.50	3.2	(3)
Dog	3	7.20	10.8	(4)
Gray fox	2	3.60	3.6	(1)
Bobcat	3	8.20	12.3	(1)
Chipmunk	1	0.10	0.1	(3)
Squirrel spp	4	0.64	1.8	weighted average
Gray squirrel	14	.50	4.9	(5)
Fox Squirrel	12	0.80	6.7	(4)
Beaver	5	16.80	58.8	(1)
Muskrat	3	1.20	2.5	(1)
Rabbit spp	15.	1.30	9.8	weighted average
Cottontail rabbit	12	1.00	6.0	(1)
Swamp rabbit	5	2.0	5.0	(1)
Deer	57	50.00	1624.5	Usable meat= 57 (4)
Total Mammal			2248.3	
Green heron	2	.20	0.1	(6)
American bittern	1	.70	0.5	(6)
Canada goose	1	3.60	2.5	(7)
Mallard/Black Duck	1	1.10	0.8	(7)
Green winged teal	1	.40	0.3	(7)
Blue winged teal	1	.40	0.3	(7)
Merlin	1	.20	0.1	(6)
Quail	2	.20	0.3	(7)
Turkey	19	5.50	73.2	(7)
Passenger pigeon	2	.10	0.1	(6)
Carolina parakeet	1	.10	0.1	(6)
Great horned owl	1	1.50	1.1	(6)
Kingfisher	1	.10	0.1	(6)
Bluejay	1	.10	0.1	(6)
Crow	1	.40	0.3	(4)
Mockingbird/Brown thrasher	1	.10	0.1	(5)
Cardinal	1	<.10	trace	(6)
Total Bird			80.0	

structure of the exploited population (Figure 6), using body weights suggested by Davis (197[illegible]) for Alabama deer on average range. Age structure was determined by comparing relatively complete mandibles to known age specimens from the George Reserve (UMMZ), combined with the criteria set forth in Severinghouse (1949). To increase the sample size, all mandibles, including those from 10 x 10s and postmolds, were included. Age was also estimated for relatively complete third molars and deciduous premolars not in association with other teeth (shown separately in Figure 6), but because these determinations were more tenuous than those obtained with relatively complete toothrows, they were not used in estimating average live weight. They are shown here because they corroborate the results obtained in aging toothrows. A 50:50 sex ratio was assumed based on small samples of deer frontals (4 male:2 female) and relatively complete innominates (1 male:2 female).[10]

Data presented in Table 21 suggest that the species of greatest importance in the diet of Mississippian populations on the Tombigbee River were deer (1624.5 kg) and bear (477.1 kg), which collectively contributed the bulk of the estimated meat yield. Minor resources appear to have included fish (134.7 kg), turkey (73.2 kg), turtles (60.6 kg), beaver (58.5 kg), and snakes (43.6 kg); in addition, substantial contributions to the diet were made by a number of small mammals -- particularly rabbits, raccoons, and squirrels.

The results of this analysis are quite similar to ethnohistoric accounts of subsistence practices in the Southeastern interior. The relative importance of taxa suggested by MNI values corresponds closely to what is known of Creek, Choctaw, Chickasaw, and Cherokee Indian utilization of animal resources. According to William Bartram, in the late eighteenth century, the animals of importance in the economy of Creek and Cherokee Indians were deer, bear, turkeys, hares, wild fowl, and various domesticated animals (Swanton 1946:286).

If ethnohistoric sources can be trusted, there is reason to suspect, based on this sample of faunal remains as well as other aspects of this site (See Peebles, Chapter 1, Volume 1; Powell, Chapter 6, this volume), that the peoples inhabiting this particular village were a subdivision of the Choctaw tribe. Geographically, the two most probable ethnic affiliations are the Choctaw and the Chickasaw. The latter are reported to have had a "distinct aversion to the flesh" of the opossum (Swanton 1946:280) and to have avoided both this species and beaver in "ancient times" (ibid:290). Other animals, including crows, owls, foxes, bobcats, and snakes (ibid), are reported to have been avoided by the Chickasaw in the late eighteenth century.[11] All of these species were found in the faunal assemblages from this village in Late Mississippian deposits.

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[10]The determination of the sex of deer innominates was done by Richard Redding.

[11]These statements regarding food taboos may be called into question since the source (Adair) may have been attempting to support his theory for an "Israelitish origin of the Indians" (ibid). However, some corroboration for the avoidance of beaver by the Chickasaw comes from a second source (Romans, in Swanton 1946:330).

TABLE 26

Comparison by Weight of Anatomical Parts Identified as Deer or Large Mammal in Mound and Village Deposits.

	Mound %	Village %	Expected[1] %
Skull	13.8	17.5	11.9
Axial Skeleton	13.7	15.6	25.5
Front Limb	31.8	20.2	17.2
Rear Limb	32.4	29.5	26.8
Lower Limbs/Feet	8.3	17.2	18.9

[1]Proportions of these anatomical parts for a single buck, aged ca. 14 mos. Total weight of skeleton = 2573.4 g.

of deer parts in a single individual and in the two archaeological samples is quite close. Although the axial skeleton is grossly underrepresented in both [illegible] ages, a pattern which can be attributed to a combination of field dressing and bone grease processing (see above), the only other marked deviations from the expected are that the front limb is more abundant and the feet less common in the mound sample. It was suggested earlier that the underrepresentation of lower limb bones in the mound area indicated that primary butchering most frequently occurred in the village. Skewing in the distribution of the front limb cannot be as easily explained. Bogan (1980:44) interpreted the similar distribution of the forelimb in deposits at Toqua as evidence that this part was "a more prestigious cut." This may be true but does not address why it might have been considered desirable. In fact, more meat can be obtained from the rear limb in both caribou and sheep (cf. Binford and Bertram 1977). In "reindeer" (a Cervid), the forequarter is 91 percent lean and 9 percent fat; the hindquarter 78 percent lean and 22 percent fat (Watt and Merrill 1963:52). The observed pattern, therefore, again suggests that selection (if responsible) was for protein rather than fat content. Another factor potentially related to the over-abundance of the front limb in the mound is that the forequarter does not appear to have been processed for storage as frequently as the rear limbs (see above). Therefore, the forelimb may have been more "expendable" in terms of the long range subsistence needs of the population and, as a result, more commonly consumed as fresh meat. These are tentative explanations for a tentative pattern. Until this distribution has been replicated at other Mississippian sites in this area, caution is recommended in interpreting the forequarter as a "choice cut."

One unusual pattern in the distribution of deer parts on the site was the abundance of skull fragments in the mound sample -- particularly in light of the paucity of deer feet. The reader should recall that the village deposit interpreted as the result of primary butchering activities yielded large quantities of both deer feet and skull fragments. However, when the contribution of the mandible to the weight of the "skull" fragments was determined for each archaeological sample, it became clear that the tongue may also have been preferentially consumed. Mandibles contributed 27.4 percent of the weight of the skull fragments from the village deposits and 61.6 percent of those from the mound.

One final pattern in the distribution of non-food faunal remains across the site deserves mention. Nearly half (16/34) of the rat or mice bones identified from the Mississippian sample were recovered from the mound: in fill, clay caps, and midden deposits as well as in the clay embankment (USN [illegible]) surrounding Structure 1. This distribution may only reflect the secondary nature of some of the mound deposits, but it might also be a subtle indication of the location of village stores.

14. Summary. The Mississippian Sample

The preceding discussion of the Mississippian faunal sample from the Lubbub Creek Archaeological Locality has been, of necessity, a rather static account. Although the faunal samples from each temporal subdivision of the Mississippian period were of disparate size, the overall similarities in the proportions of taxa recovered suggest remarkable stability in the human exploitation of animal populations from 1000 A.D. to 1600 A.D. Of foremost economic importance were deer, bear, and wild turkey, with minor contributions

to subsistence being made by a number of species, including beaver, rabbits, and raccoons.

In sharp contrast to other studies of Mississippian subsistence (Smith 1975), aquatic resources such as fish and migratory waterfowl do not appear to have been of much importance in central Alabama. The differences apparent between Mississippian subsistence patterns near the Mississippi River and those on the Tombigbee River undoubtedly can best be attributed to differences in availability resulting from the configuration of the natural environment. These archaeologically observable differences in the exploitation of animal populations suggest that with further study, it will be possible to distinguish regional variability in the single Southeastern "economic province" referred to by Swanton (1946).

The kinds and proportions of species recovered in this particular faunal sample most closely approximate the patterns of animal exploitation documented by European colonists for the Choctaw tribe, although this possibility can be evaluated only with reference to the results of future faunal analyses in Alabama, eastern Mississippi, and Tennessee. Potentially also of some value in addressing such culture historical questions are the patterns observed in butchering practices and refuse disposal. John Yellen (1977:327-328), for example, has argued that all cultural groups probably "leave a distinct cultural imprint on the faunal materials which are the final and incidental byproducts of meat consumption" and that these remains can therefore be examined as "the visible end product of a series of cultural rules." Mississippian butchering patterns were discussed in some detail in a preceding section of this chapter. One of the most consistent patterns observed in this Mississippian assemblage of deer bones is the apparent custom of incinerating bones from the lower legs and feet, a custom probably related to disposal of the remains. Comparative studies of this kind of patterning in the treatment of bone could prove useful in detecting cultural groups archaeologically.

The differential distribution of fauna in mound and village deposits may also be of some significance for future studies in this area. The proportions of fauna in samples from these two areas of the site suggest that fish, in particular, were preferentially consumed by only a small segment of the population. In addition, the skewed distribution of deer parts on the site, with the forelimb and the mandible overrepresented in mound deposits, is in partial agreement with the findings of a similar study (Bogan 1980). If these patterns are replicated on a regional basis, it may be possible to address prehistoric taste preferences -- assuming, of course, that such preferences were at least partially responsible for the patterns observed archaeologically. These data, in turn, might be useful in detecting status differences in conjunction with architecture and mortuary analyses.

The final characteristic of this assemblage that requires mention is the marked variability that was observed in the faunal content of each deposit. The proportions of taxa, the anatomical parts represented, and the species found in association made each feature unique. Some attempts have been made in this report to interpret the composition of these features in terms of prehistoric activities (specifically butchering and meat processing) and to use the archaeological association of species to infer seasonal patterns of animal exploitation. Although these attempts met with only limited success, the potential of such an approach is considerable.

The Historic Occupation

Under certain circumstances, the identification of animal bones more closely resembles an art than a science. This is particularly true when an attempt is made to distinguish between taxa that are as closely related (and osteologically indistinguishable) as are Bison (Bison bison) and domestic Cattle (Bos taurus). Such an opportunity presented itself with the sample from the Lubbub Creek Archaeological Locality. In alignment with four human burials dating to the Summerville I period was a nearly complete skeleton of an immature bovid (Burial 2, 500N/-300E, USN 4772). Missing were only the skull and the lumbar vertebrae (Figure 7). Because this interment appeared to be associated with the human burials and because the bone was rather leached and therefore suggestive of some antiquity, Bison bison seemed a strong possibility. But because the specimen was immature, the available comparative material was mature, and the published manual for distinguishing the two species was also based on mature animals (Olsen 1960), it was necessary to seek outside help in the identification. Therefore, the bones were taken to the Zooarchaeological Identification Centre[15] in Ottawa, Ontario, in order to gain access to a more extensive comparative collection (for these species) and an unpublished manual for distinguishing the two (Cumbaa and Balkwill 1978).

As it turned out, the individual was a cow of unknown antiquity. Twenty-six of the 28 characters present in recognizable form on the archaeological specimen more closely resembled immature Bos taurus than Bison bison (Table 27). Although the distinctions between the two species were invariably subtle, it seems clear that the individual was undoubtedly not a bison.

More doubt exists with a single metacarpus recovered from Hectare 100N/-300E during Phase I testing (USN 653). Two of the characters deemed relevant to distinguishing between Bos and Bison by Cumbaa and Balkwill more closely resembled Bison than Bos. However, as noted by Olson (1960), some breeds of cattle introduced to the United States from India are intermediate between the two species. Because the bone was exceptionally well preserved in the absence of mussel shell, the hectare exhibited little evidence of prehistoric occupation, and the area has been in pasture for 20 years or more, I am inclined to suspect that the element is of recent origin.

Faunal remains were recovered from one undisputed early historic component in the Lubbub Creek Archaeological Locality. A 5 x 10 m unit (USN 4549) near the mound yielded ceramics dated to the early eighteenth century, worked glass, fragments of a pig (Sus scrofa) mandible, and a probable cow (cf. Bos taurus) humerus. Fauna from this assemblage was not coded (and therefore is not included in the data bank) because it was a plowzone sample and appeared to be extensively mixed. Deer, rabbit (Sylvilagus spp.), squirrel (Sciurus spp.), turkey, softshell turtle (Trionyx spp.), river cooter (Chrysemys concinna), bowfin, and drum were also present in the sample.

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[15]The Zooarchaeological Identification Centre is a part of the National Museum of Natural Sciences and is directed by Dr. Ann Rick.

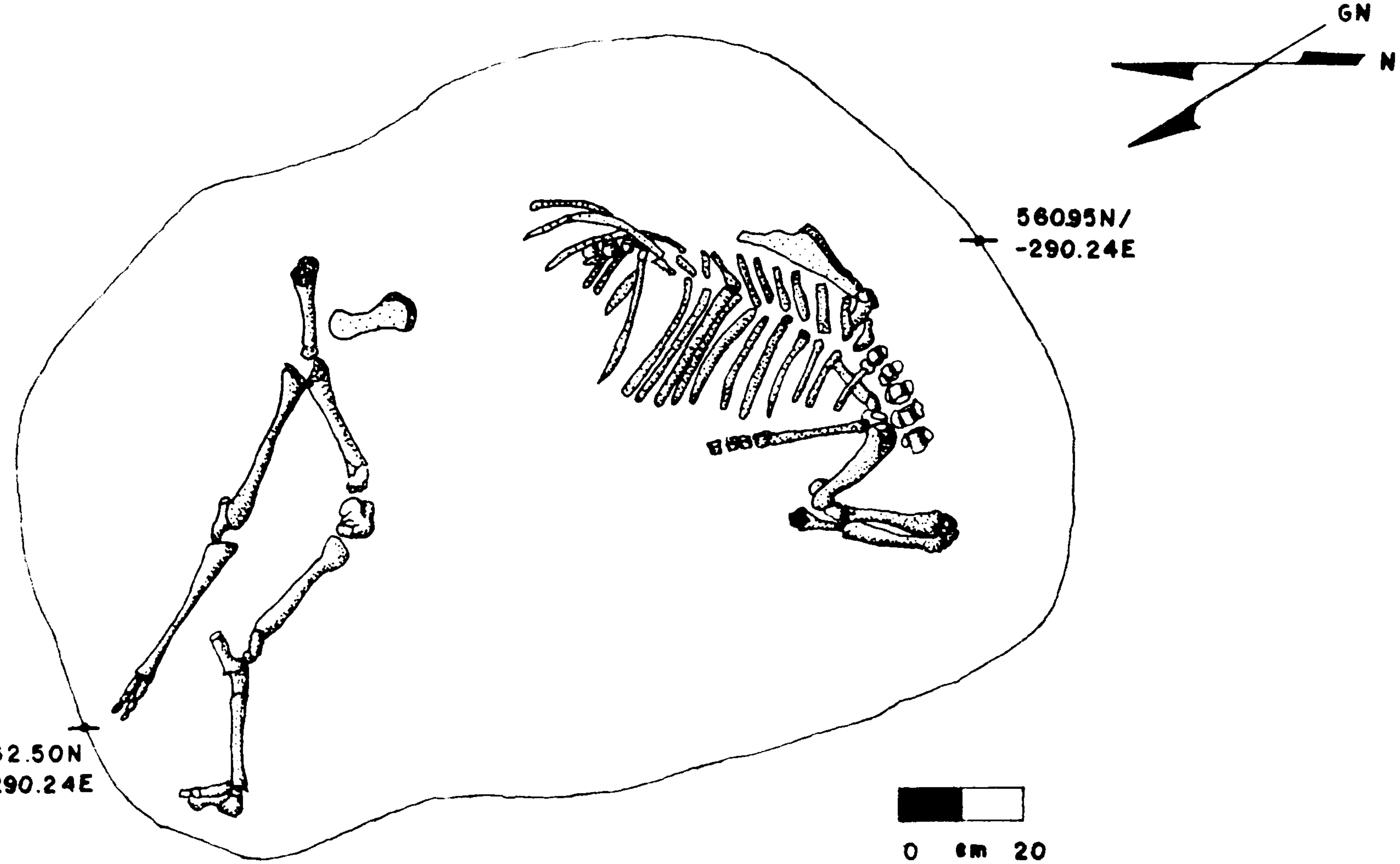

Figure 7. The cow (Bos taurus) interred in Hectare 500N,-300E.

TABLE 27

Characters Used in the Identification of Burial 2 (USN 4772).

Element	Identification	Character #[1]	# Elements
Scapula	Bos	2	1
	Bos	3	1
Humerus	cf. Bos	7	1
Radio-ulna	cf. Bos	5	1
	Bos	7	1
	Bos	11	1
Carpal 2-3	Bos	3	1
	Bos	6	1
Carpal 4	cf. Bos	1	1
Radial carpal	Bos	5	1
Ulna carpal	cf. Bos	4	1
Intermediate carpal	Bos	1	1
	Bos	3	2
Femur	cf. Bos	10	1
	cf. Bos	14	1
Tibia	cf. Bos	4	1
	Bos	8	1
Metatarsus	Bos	3	1
Astragalus	Bos	1	1
	Bos	2	2
	cf. Bison	5	1
Tarsal 2-3	Bos	1	1
	Bison	2	1
	Bos	3	1
Lateral Malleolus	Bos	4	1
	Bos	5	1
	Bos	7	1
Ribs	Bos	1	6

[1]From Cumbaa and Balkwill (1978).

Subsistence Change in the Tombigbee Valley: A Comparison of Late Woodland and Mississippian Faunal Assemblages

Great care must be exercised in comparing the fauna from Late Woodland and Mississippian sites in the Gainesville Lake because the archaeological assemblages are not directly comparable in several respects. The assemblages reflect the opinions of three analysts with different resources at their disposal, but more importantly, the assemblages from some Late Woodland periods are incomplete samples of the fauna procured on a year-round basis. As a result, quantitatively assessing change in the exploitation of animal populations through time is not possible with the present state of our knowledge. It is, however, possible to document the shift in subsistence from a hunting and gathering to an agriculturally based economy with the available faunal remains.

Dependence on agriculture is manifested archaeologically in ethnobotanical remains and by site placement in relation to arable land; but it may also be inferred from a change in the composition of fauna. The distribution and abundance of animal species (other than carnivores) is directly related to the kind and quantity of vegetation available. Therefore, if for some reason the vegetation of a region is modified, the nature of this modification will be reflected by the fauna.

The intensification of agriculture entailed extensive modification of the vegetation in the Tombigbee River Valley. Land was cleared, tilled, and abandoned to lie fallow for months, years, or perhaps even permanently if yields were lower than anticipated. The natural vegetation in the vicinity of villages, therefore, was transformed from a climax bottomland (hardwood) forest to a mosaic of grassland and second-growth mixed pine-hardwood forests.

Fauna which are particularly sensitive to such microenvironmental alteration include rats, mice, squirrels, and rabbits. Each of these taxa are represented in the study area by two or more species with different habitat preferences. Furthermore, these species probably either lived within the confines of the village (rats, mice, and possibly some rabbits) or were procured nearby, and therefore accurately reflect the vegetation in the vicinity of the site.

Although it has been suggested in this chapter that the initial intensification of agriculture occurred in Late Miller III, it is not possible to evaluate this interpretation with paleoenvironmental data at this time. Neither Curren nor Woodrick were able to identify to species the squirrels and rabbits in Woodland assemblages with the comparative material available to them; furthermore, the discrepancies in sample size per cultural period preclude comparisons of species abundance through time, particularly during the Mississippian period. Some interesting and informative contrasts can be drawn, however, between composite Woodland and Mississippian samples; and it is possible to compare the frequency of these species in Middle Miller III and Mississippian samples analyzed in this report. Nearly all of these comparisons indicate relatively large scale land clearance during the Mississippian period.

The ratio of gray squirrel (<u>S. carolinensis</u>) to fox squirrel (<u>S. niger</u>) fragments, for example, is a good indicator of forest composition. Gray

squirrels are denizens of climax hardwood forests and are gradually replaced by fox squirrels under conditions of primary forest succession -- a circumstance occurring when land is cleared and then abandoned for many years. Fox squirrels are much "more tolerant of open conditions than are gray squirrels" (Golley 1962:100), a situation likely to arise with the land clearance patterns documented historically for Southeastern Indians in which very large trees were left standing in fields (cf. Hudson 1976). Fox squirrel fragments were much more abundant in Mississippian samples. The ratio of gray squirrel to fox squirrel fragments in the Middle Miller III sample was 12:1; in the composite Mississippian sample, 1.8:1. This marked increase in the frequency of fox squirrels strongly suggests partial deforestation of the surrounding area.

This observation is paralleled by the ratio of cottontail (*S. floridanus*) to swamp rabbit (*S. aquaticus*) fragments in Middle Miller III and Mississippian assemblages. Cottontails are typically found in "fairly open country, pastures, and grassy areas adjacent to croplands" (Lowery 1974:159). The early successional stages of fields and forests afford ideal habitat for this species (Smith 1975:92), although the Black Belt prairie west of the village would also have supported high densities, as noted by Curren (1974:231). The ratio of cottontail to swamp rabbit fragments in Middle Miller III was 2:1; in the Mississippian assemblage, the ratio was 6.5:1.

The relative frequency of rabbits[16] also appears to increase significantly in the Mississippian sample. Rabbits contributed 10 percent of the identified mammalian fragments in the Mississippian sample from the Lubbub Creek Archaeological Locality, whereas at various Late Woodland sites (1Gr1x1, 1Gr2, 1Pi61) located downriver, this percentage varied from 2 to 6 percent (Woodrick 1979). The Late Miller III component (1Pi33) in the Lubbub Creek Archaeological Locality, analyzed by Woodrick (*ibid*), yielded far fewer rabbit bones (4.3 percent of mammalian fauna) than the Mississippian sample, suggesting that considerably more land within the village catchment was cleared during the later prehistoric period.[17]

The apparent increase in rabbits during the Mississippian period must be interpreted with caution, however, since the pattern could also be the result of scheduling conflicts in the procurement of certain animal resources. Based on the seasonality information inferred from the Middle Miller III component, the autumn harvest may have coincided with peak periods of exploitation for some small mammals -- notably raccoons and opossums -- but not rabbits (Table 28). Raccoons and opossums may not have been exploited as frequently after agricultural products gained ascendency in the diet due to the labor demands of harvesting and processing large quantities of cultigens for storage. Raccoons, in particular, seem to have played a somewhat larger role in the subsistence economy of peoples living on the Tombigbee River during the

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[16]Includes both species as well as *Sylvilagus* spp. to allow comparison with previous analyses.

[17]Although rabbits contributed 20 percent of the identified mammalian fragments in the Middle Miller III sample from the Lubbub Creek Archaeological Locality, the probability of ampling error is very high since only 30 mammal bones were identified to family, genus, or species.

Woodland period. However, given the above cited paleoenvironmental data, and the expectation that carrying capacity for raccoons would have dropped considerably with the loss of numerous denning trees, it seems reasonable to conclude that the observed relative increase in rabbits is at least partially a result of land clearance.

Rats and mice are the final species that are of some utility in paleoenvironmental reconstruction. Again, these species suggest extensive land clearance during the Mississippian period.

The two rats identified from the Mississippian sample, Hispid Cotton Rat (Sigmodon hispidus) and Marsh Rice Rat (Oryzomys palustris), suggest that some garden plots were located very close to the village. Both of these species have home ranges of well less than a hectare (Lowery 1974:253), and therefore must have lived in or very near the village unless they were purposefully carried in as food sources. Although the moisture requirements of the two species are different, with cotton rats preferring drier habitats than rice rats, both species are typically found in overgrown areas such as old fields (ibid). In fact, these two species are frequently identified from many late prehistoric assemblages, and rice rats appear to have extended their range northward prehistorically as agriculture became a focal point of the economy in the eastern United States (Guilday 1971:18). In contrast, the only rat identified in Woodland components was a Wood Rat (Neotoma floridana) identified by Curren in the 1Gr2 assemblage. As its name implies, wood rats frequent hardwood bottomland forests (ibid:256).

Not all of the land surrounding the Mississippian village in the Lubbub Creek Archaeological Locality was cleared, however. The three mice identified from the Mississippian component, White-footed mouse (Peromyscus leucopus), Cotton mouse (Peromyscus gossypinus) and Pine Vole (Microtus pinetorum), are all primarily woodland species. Both species of the genus Peromyscus are found in river bottom forests (Golley 1962), suggesting that at least some portion of the floodplain surrounding the village on three sides was not under cultivation prehistorically. The pine vole, typically found in hardwood or mixed pine-hardwood forests, may have been a recent inclusion. This species lives in underground burrows and was recovered from the plowzone (10 x 10, USN 4719 in Hectare 500N/-300E).[18] The single element recovered, a mandible, was not burned.

Because agriculture is labor intensive, it was postulated earlier that this shift in subsistence was made because the hunting and gathering of wild resources in sufficient quantities to support the population was no longer less costly in terms of labor requirements. Two lines of evidence suggest that larger quantities of animal resources were being harvested during Middle Miller III than in previous Woodland periods: first, it appears to have become necessary for the Middle Miller III population to travel greater distances in search of game during the fall -- distances so great, in fact, that temporary hunting camps were established; second, a relative lack of selectivity in resource procurement is suggested by the very small size of fishes consumed during the Middle Miller III period. Although the latter

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[18]This species is not included in species lists because it was recovered from a 10 x 10 m unit.

TABLE 28

Bone Count Frequencies for Small Mammals Harvested in Fall and Winter During the Woodland and Mississippian Periods.

	Woodland		Mississippian	
	Pieces	%	Pieces	%
Fall species				
Opossum	78	15.9%	70	14.1%
Raccoon	100	20.4%	40	8.0%
Gray fox	20	4.1%	13	2.6%
Bobcat	4	0.8%	5	1.0%
TOTAL FALL KILLED SPECIES	202	(41.2%)	128	(25.7%)
Winter or year-round[2]				
Rabbits	135	27.6%	221	44.3%
Squirrels	153	31.2%	149	29.9%
TOTAL WINTER KILLED SPECIES	288	(58.8%)	370	(74.3%)

[1] Includes data from this analysis and that of Woodrick (1979)
[2] Based on seasonal information inferred from Middle Miller III sample, this report.

cannot be evaluated at this time with respect to the average weights of the fish caught by woodland populations preceding and following the Middle Miller III period,** there is a striking and significant difference between the size of fishes consumed during the Mississippian periods and those utilized by the Middle Miller III population (See Appendix C). The mean weight of fishes recovered from Middle Miller III contexts was .52 kg (1.1 lbs; n=61) versus [illegible] kg ([illegible] lbs; n=164) for the Mississippian sample. The median weight of fish in the Middle Miller III sample was .25 kg (.6 lbs); in the Mississippian assemblage, .7[illegible] kg (1.6 lbs). This difference is not a result of recovery techniques; both samples include only materials recovered from one-quarter inch mesh.

It was further proposed that the initial intensification of agriculture occurred during Late Miller III. This interpretation is based on a relative increase in large mammal remains in Late Miller III samples -- a trend which continues into and through the Mississippian periods until the large quantity of large mammal remains noted in Early Miller III deposits is nearly equalled. Such a pattern might be expected to result if the Late Miller III and Mississippian populations assumed a lower position on the food chain, i.e, they consumed greater quantities of plant foods and less animal protein. This increased reliance on plant foods could not have been accomplished in the absence of the artificially high yields of cultivated plants.

If these interpretations are valid, supporting evidence should be available from several classes of archaeobiological data. Somewhat greater selectivity in fish resources should be apparent in Late Miller III faunal samples once the need for large quantities of animal resources was alleviated. Larger quantities of cultigens should occur in botanical samples dating to this period. In addition, some evidence of chronic, or at least periodically acute, nutritional stress should be apparent in human skeletal remains dating to the Middle Miller III period if, in fact, the potential of the resource base had been approached or surpassed. Finally, the quantity of strontium in human bone should reflect the reorganization of trophic relationships between Middle and Late Miller III.

Many factors, including technology and the organization of production, which should be considered have been ignored in this concluding discussion. Larger fish may have been procured during the Mississippian period because some more effective means of capture was available. The relative increase in large mammals subsequent to Middle Miller III could be attributable, at least in part, to a reorganization of the labor force responsible for procuring animal resources. These are avenues of inquiry for future research.

**[illegible] presents approximate lengths for some fish species in [illegible] samples, insufficient comparative material precluded the identification [illegible] of the smaller species.

[illegible], Weight, and Minimum Numbers of Individuals for [illegible]

	Miller I:II					Middle Miller III					Late Miller [illegible]				
	Ct	%	Wt. (g)	%	MNI	Ct	%	Wt (g)	%	MNI	Ct	%	Wt (g)	%	MNI
[illegible]	1	2.8	0.4	4.6	1	2	0.1	0.60	0.2	1					
[illegible]						2	0.1	3.40	0.9	1					
[illegible]						1	0.1	0.50	0.1	1					
[illegible]						1	0.1	0.10	0.1	1					
[illegible]	1	2.8	0.2	2.3	1	3	0.2	1.50	0.4	1					
[illegible]						12	0.7	1.40	0.4	1					
[illegible]	1	2.8	0.5	5.7	1	1	0.1	0.10	*	1					
[illegible]						4	0.2	0.60	0.2	1					
[illegible]	1	2.8	0.3	3.4	1	1	0.1	0.10	*	1					
[illegible]						1	0.1	2.00	0.5	1					
[illegible]	1	2.8	2.1	23.9	1	30	1.8	93.30	25.0	2					
[illegible] Mammal	5	13.9	3.5	39.3		58	3.5	103.00	27.8						
[illegible] Mammal	3	8.3	1.1	12.5		340	20.7	152.90	49.0		6	75.0	1.4	87.5	
[illegible] Mammal						1	0.1	0.10	*						
[illegible] Mammal	17	47.2	2.8	31.9		119	7.2	16.40	1.4		1	12.5	0.1	6.3	
GRAND TOTAL MAMMAL	25	69.4	7.4	84.3		518	31.5	273.30	73.2		7	87.5	1.5	93.8	
[illegible]						1	0.1	0.10	*	1					
[illegible]						1	0.1	0.20	0.1	1					
[illegible]						1	0.1	2.10	0.6	1					
[illegible]						3	0.2	2.40	0.6						
[illegible]	2	5.6	0.3	3.4		14	0.9	6.80	1.8						
[illegible]						15	0.9	1.15	0.3						
[illegible]						3	0.2	0.10	*						
[illegible]	5	13.9	0.5	5.7		55	0.3	7.50	2.0		1	12.5	[illegible]	6.3	
GRAND TOTAL [illegible]	7	19.4	0.8	9.1		90	5.5	17.95	4.8		1	12.5	0.1	6.3	

APPENDIX [illegible]

(Continued)

	[illegible] Miller III					Middle Miller III					Late Miller III				
	Ct	%	Wt. (g)	%	MNI	Ct	%	Wt. (g)	%	MNI	Ct	%	Wt. (g)	%	MNI
[illegible]															
[illegible]	[illegible]	[illegible]	[illegible] 2	2.3	1	27	1.6	[illegible].30	1.4	2					
[illegible]						4	0.2	[illegible]	[illegible]						
[illegible]						11	0.7	13.[illegible]	3.6						
[illegible]						2	0.[illegible]	[illegible]	0.7						
[illegible]						1	0.1	2.60	0.7	1					
[illegible]						1	0.1	0.20	0.1	1					
[illegible]						6	0.4	4.20	1.1	1					
[illegible]	[illegible]	2.8	0.2	2.3		52	[illegible]	31.[illegible]	8.5						
[illegible]	2	5.6	0.3	3.4		143	8.7	22.[illegible]	5.9						
GRAND TOTAL [illegible]	3	5.6	0.5	5.7		195	15.[illegible]	53.8	14.4						
[illegible]						4	0.2	0.35	0.1						
[illegible]						1	0.1	0.10	*	1					
[illegible]						1	0.1	0.10	*	1					
Total Identified Snake						6	0.4	0.55	0.1						
Unidentified Snake						1	0.1	0.05	*						
GRAND TOTAL SNAKE						7	0.6	0.6[illegible]	[illegible]						
GRAND TOTAL REPTILE	3	5.0	0.5	5.7		202	12.3	51.[illegible]	14.6						
AMPHIBIANS															
Frog						6	0.4	0.40	0.1	5					
Frog/Toad						1	0.1	[illegible].04	*						
GRAND TOTAL AMPHIBIAN						7	0.4	[illegible].44	0.1						
FISHES															
Bowfin						28	1.7	3.36	0.9	8					
Shad/Herring						1	0.1	0.05	*	1					
Grass pickerel						1	0.1	0.08	*	1					
Minnow (family)						1	0.1	0.01	*	1					
Sucker (family)						2	0.1	0.15	*	1					
[illegible]sucker						2	0.1	0.20	0.1	2					

	M[illegible] II					M[illegible] III					[illegible]				
	N	%	Wt (kg)	%	MO[illegible]	N	%	Wt (kg)	%	MO[illegible]	N	%	Wt (kg)	%	MO[illegible]
[illegible]						1	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						5	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						6	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						3	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						6	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						1	[illegible]	[illegible]	[illegible]	1					
[illegible]						1	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						1	0.1	[illegible]	[illegible]	[illegible]					
[illegible]						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						15	0.9	0.86	[illegible]	[illegible]					
[illegible]						11	0.7	0.86	0.2	[illegible]					
[illegible]						[illegible]	[illegible]	0.79	[illegible]	[illegible]					
[illegible]						[illegible]	0.1	[illegible]	[illegible]	1					
[illegible]						2	0.1	[illegible]	[illegible]	1					
[illegible]						2	[illegible]	[illegible]	[illegible]	[illegible]					
[illegible]						1	0.1	[illegible]	[illegible]	1					
[illegible]						[illegible]	[illegible]	[illegible]	[illegible]	5					
[illegible]						141	8.6	16.31	4.5						
[illegible]	1	2.8	0.08	0.9		290	17.7	10.20	2.7						
[illegible]	1	2.8	0.08	0.9		431	26.2	27.11	7.3						
[illegible]	36	100.0	8.78	100.0		1248	100.0	373.30	100.0		8	100.0	1.6	100.0	
[illegible]	9		1.60			395		33.20			7		0.2		
[illegible]	45		10.38			1643		406.50			15		1.8		

AD-A155 048 PREHISTORIC AGRICULTURAL COMMUNITIES IN WEST CENTRAL ALABAMA VOLUME 2 STU..(U) MICHIGAN UNIV ANN ARBOR MI DEPT OF ANTHROPOLOGY C S PEEBLES 1983 C-5861(79) 5/6

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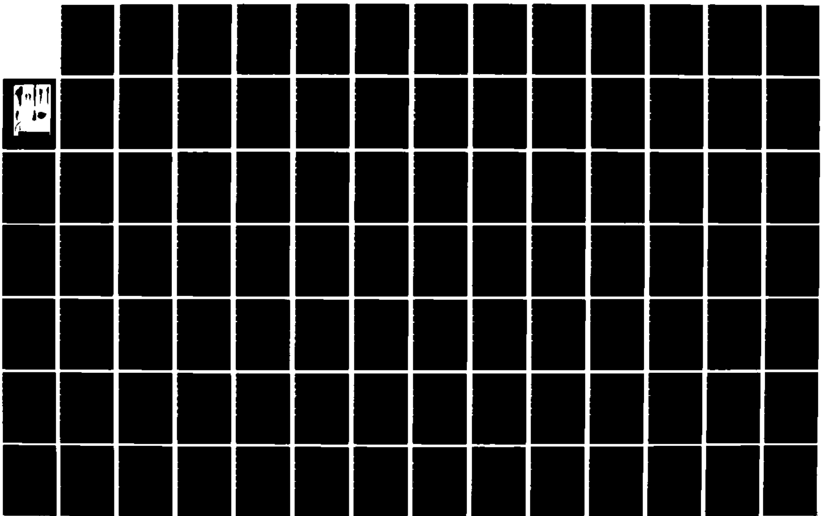

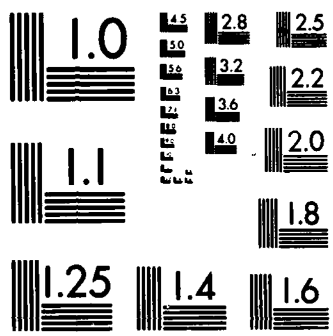
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APPENDIX B

Count, Weight, and Minimum Numbers of Individuals per Cultural Period for Mississippian Fauna

	Summerville I					Summerville II-III				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
MAMMALS										
Opossum						2	*	0.7	*	1
Black bear	1	0.1	1.1	0.1	1	1	*	3.8	0.1	1
Raccoon						4	0.1	0.9	*	1
Mink										
Striped skunk						1	*	0.2	*	1
Dog/Wolf	1	0.1	0.4	*	1	5	0.1	4.5	0.1	1
Dog										
Gray fox										
Bobcat										
Chipmunk						1	*	0.2	*	
Squirrel spp.	4	0.4	0.4	*		6	0.1	1.9	*	
Gray squirrel	1	0.1	0.1	*	1	17	0.3	3.8	0.1	2
Fox squirrel						5	0.1	1.3	*	1
Beaver	8	0.7	13.2	1.7	1	2	*	2.0	*	1
Rat/Mouse						2	*	0.2	*	
Cotton mouse										
White-footed mouse						1	*	0.1	*	1
Rice rat	6	0.6	0.2	*	1	5	0.1	0.3	*	2
Cotton rat	1	0.1	0.2	*	1					
Muskrat						10	0.2	10.0	0.2	3
Rabbit spp.	12	1.1	4.4	0.6		31	0.6	16.3	0.4	
Cottontail rabbit	3	0.3	2.4	0.3	1	9	0.2	3.2	0.1	2
Swamp rabbit	1	0.1	1.2	0.2	1	1	*	0.6	*	1
Deer	80	7.4	324.1	41.4	2	329	6.6	1968.2	45.0	6
Total Identified Mammal	118	11.0	347.7	44.4		432	8.7	2018.8	46.2	
Unidentified Rodent						2	*	0.4	*	
Large Carnivore										
Medium Carnivore						5	0.1	1.5	*	
Small Carnivore										
Large Mammal	627	58.3	336.5	43.0		2856	57.2	1671.6	38.2	
Medium Mammal	3	0.3	1.1	0.1		13	0.3	7.8	0.2	
Small Mammal	64	5.9	11.9	1.5		450	9.0	108.1	2.5	
Unidentified Mammal	1	0.1	0.1	*		13	0.3	15.7	0.4	
GRAND TOTAL MAMMAL	813	75.6	697.3	89.1		3771	75.5	3823.9	87.5	

(Continued)

	Summerville I					Summerville II-III				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
REPTILES (Continued)										
Cooter/Slider/Map turtle	1	0.1	0.80	0.1		15	0.3	20.80	0.5	
Cooter/Slider	1	0.1	2.70	0.3		7	0.1	18.60	0.4	
Painted turtle										
River cooter	2	0.2	4.50	0.6	1	1	*	3.20	0.1	1
Pond slider						2	*	17.40	0.4	1
Box turtle	4	0.4	1.10	0.1	1	23	0.5	37.00	0.9	1
Chicken turtle										
Softshell turtles (family)	6	0.6	4.50	0.6	1	44	0.9	22.80	0.5	
Smooth softshell						1	*	0.50	*	1
Total Identified Turtle	24	2.2	17.40	2.2		130	2.6	142.00	3.3	
Unidentified Turtle	69	6.4	13.30	1.7		290	5.8	62.80	1.4	
GRAND TOTAL TURTLE	93	8.7	30.70	3.9		420	8.4	204.80	4.7	
Non-poisonous snakes	1	0.1	0.10	*		11	0.2	1.10	*	
Water snake										
Garter/Ribbon										
Black racer	4	0.4	0.40	*	1	7	0.1	1.00	*	1
Coachwhip										
Black racer/Coachwhip						1	*	0.10	*	
King/Milk snakes						1	*	0.10	*	1
Rat snakes										
King/Milk/Rat snakes	2	0.2	0.30	*	1					
Mud snake						1	*	0.20	*	1
Poisonous snakes (family)						5	0.1	1.60	*	
Copperhead/Cottonmouth										
Rattlesnake						2	*	1.70	*	1
Total Identified Snake	7	0.7	0.80	0.1		28	0.6	5.80	0.1	
Unidentified Snake						5	0.1	0.50	*	
GRAND TOTAL SNAKE	7	0.7	0.80	0.1		33	0.7	6.30	0.1	
Lizard										
GRAND TOTAL REPTILE	100	9.3	31.50	4.0		453	9.1	211.10	4.8	
AMPHIBIANS										
Amphiuma										
Frog						1	*	0.10	*	1
Frog/Toad	1	0.1	0.30	*	1					
Salamander	1	0.1	0.01	*	1					
GRAND TOTAL AMPHIBIAN	2	0.2	0.31	*		1	*	0.10	*	

APPENDIX B

(Continued)

	Summerville I					Summerville II-III				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
BIRDS										
Green heron						1	*	0.1	*	1
Canada goose						1	*	0.3	*	1
Mallard/Black duck										
Green-winged teal	1	0.1	0.2	*	1					
Blue-winged teal										
American bittern										
Merlin (Pigeon hawk)										
Bob-white quail						3	0.1	0.4	*	1
Wild turkey	8	0.7	20.8	2.7	1	30	0.6	89.1	2.0	2
Passenger pigeon										
Great horned owl						1	*	0.5	*	1
Carolina parakeet										
Kingfisher										
Bluejay										
Crow										
Cardinal										
Mockingbird/Brown Thrasher										
Total Identified Bird	9	0.8	21.0	2.7		37	0.7	90.4	2.1	
Large Bird	11	1.0	4.5	0.6		267	5.3	162.0	3.7	
Medium Bird	1	0.1	0.3	*		52	1.0	6.5	0.2	
Small Bird						3	0.1	0.8	*	
Unidentified Bird	97	9.0	22.4	2.9		205	4.1	49.4	1.1	
GRAND TOTAL BIRD	118	11.0	48.2	6.2		563	11.3	309.1	7.1	
REPTILES										
Snapping turtles (family)										
Alligator snapping turtles										
Snapping turtle										
Mud-musk turtle (family)	3	0.3	0.60	*	1	12	0.2	3.50	0.1	1
Emydine turtles (family)	7	0.7	3.20	0.4		25	0.5	18.20	0.4	
Map turtles										

APPENDIX B

(Continued)

	Summerville I					Summerville II-III				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
FISH										
Gar (family)						15	0.3	2.80	0.1	1
Longnose gar						2	*	2.00	*	2
Spotted gar						1	*	0.09	*	1
Alligator gar						1	*	0.60	*	1
Bowfin	3	0.3	0.28	*	3	18	0.4	3.35	0.1	6
Shad/Herring (family)	2	0.2	0.20	*	1					
Grass pickerel						1	*	0.02	*	1
Sucker (family)						3	0.1	0.15	*	
Smallmouth buffalo	1	0.1	0.10	*	1	1	*	0.10	*	1
Redhorse						4	0.1	0.43	*	2
River redhorse						1	*	0.20	*	1
Golden redhorse						1	*	0.10	*	1
Catfish (family)	4	0.4	0.50	0.1		9	0.2	0.72	*	3
Catfish (Ictalurus spp.)	1	0.1	0.10	*	1	5	0.1	0.28	*	2
Blue catfish	1	0.1	0.10	*	1	3	0.1	1.10	*	2
Channel catfish						1	*	0.10	*	1
Blue/Channel catfish						3	0.1	0.40	*	2
Brown bullhead						3	0.1	0.19	*	2
Madtom										
Flathead catfish	1	0.1	0.30	*	1	1	*	0.10	*	1
Sunfish (family)						4	0.1	0.25	*	1
Bluegill (Lepomis spp.)										
Bass	1	0.1	0.10	*	1	5	0.1	0.37	*	3
Crappie						1	*	0.05	*	1
Drum	7	0.7	1.90	0.2	4	19	0.4	6.71	0.2	8
Total Identified Fish	21	2.0	3.58	0.5		102	2.0	20.11	0.5	
Unidentified Fish	21	2.0	2.10	0.3		102	2.0	7.18	0.2	
GRAND TOTAL FISH	42	3.9	5.68	0.7		204	4.1	27.29	0.6	
Total Identified Bone	1075	100.0	782.99	100.0		4992	100.0	4371.49	100.0	
Unidentifiable Bone	748		106.40			2731		319.30		
GRAND TOTAL BONE	1823		889.39			7723		4690.79		

APPENDIX B

(Continued)

	Summerville IV					Mississippian				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
MAMMALS										
Opossum	45	0.9	25.50	0.5	2	23	0.2	10.00	0.1	1
Black bear	5	0.1	38.90	0.8	1	7	0.1	50.60	0.7	2
Raccoon	18	0.4	19.40	0.4	2	18	0.2	11.80	0.1	2
Mink						1	*	0.50	*	1
Striped skunk	1	*	0.50	*	1	1	*	1.50	*	1
Dog/Wolf	4	0.1	10.60	0.2	1					
Dog						2	*	5.90	0.1	1
Gray fox	2	*	1.50	*	1	11	0.1	11.20	0.1	1
Bobcat	2	*	13.30	0.3	1	3	*	11.20	0.1	1
Chipmunk										
Squirrel spp.	16	0.3	3.50	0.1	2	18	0.2	2.70	*	
Gray squirrel	25	0.5	9.20	0.2	4	25	0.3	9.90	0.1	2
Fox squirrel	14	0.3	5.70	0.1	2	18	0.2	5.80	0.1	3
Beaver						10	0.1	24.90	0.3	1
Rat/Mouse						1	*	0.10	*	
Cotton mouse						3	*	0.50	*	1
White-footed mouse										
Rice rat						5	0.1	0.40	*	1
Cotton rat	5	0.1	1.00	*	1	5	0.1	0.60	*	2
Muskrat										
Rabbit spp.	57	1.2	20.50	0.4	2	46	0.5	12.30	0.2	
Cottontail rabbit	23	0.5	14.60	0.3	2	30	0.3	11.50	0.2	3
Swamp rabbit	4	0.1	5.80	0.1	1	4	*	2.20	*	1
Deer	500	10.5	2294.50	48.4	7	704	7.3	3479.20	46.4	8
Total Identified Mammal	721	15.2	2464.50	52.0		935	9.7	3652.80	48.7	
Unidentified Rodent	1	*	.05	*		6	0.1	1.00	*	
Large Carnivore	1	*	.80	*						
Medium Carnivore	4	0.1	1.10	*		4	*	2.70	*	
Small Carnivore	1	*	.40	*		4	*	0.60	*	
Large Mammal	2536	53.4	1617.70	34.1		5843	60.7	2970.80	39.6	
Medium Mammal	3	0.1	3.40	0.1		28	0.3	12.90	0.2	
Small Mammal	283	6.0	62.20	1.3		545	5.7	102.15	1.4	
Unidentified Mammal	15	0.3	5.30	0.1		19	0.2	6.60	0.1	
GRAND TOTAL MAMMAL	3565	75.0	4155.45	87.7		7384	76.7	6749.55	90.1	

APPENDIX B

(Continued)

	Summerville IV					Mississippian				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
BIRDS										
Green heron						1	*	0.30	*	1
Canada goose										
Mallard/Black duck	1	*	.20	*	1					
Green-winged teal	1	*	.20	*	1	2	*	0.30	*	1
Blue-winged teal						1	*	0.10	*	1
American bittern	1	*	.10	*	1					
Merlin (Pigeon hawk)						1	*	0.05	*	1
Bob-white quail	2	*	.30	*	1					
Wild turkey	76	1.6	243.90	5.2	4	76	0.8	178.05	2.4	3
Passenger pigeon	1	*	.30	*	1	1	*	0.10	*	
Great horned owl										
Carolina parakeet						1	*	0.40	*	
Kingfisher	1	*	.10	*	1					
Bluejay						1	*	0.10	*	
Crow						1	*	0.20	*	
Cardinal						1	*	0.20	*	
Mockingbird/Brown Thrasher						1	*	0.05	*	
Total Identified Bird	82	1.7	244.90	5.3		87	0.8	179.85	2.4	
Large Bird	41	0.9	23.80	0.5		165	1.7	84.60	1.1	
Medium Bird	6	0.1	1.20	*		29	0.3	5.20	0.1	
Small Bird	3	0.1	.50	*		4	*	0.40	*	
Unidentified Bird	452	9.5	124.95	2.6		725	7.5	147.00	2.0	
GRAND TOTAL BIRD	585	12.3	395.55	8.3		1010	10.5	417.05	5.6	
REPTILES										
Snapping turtles (family)						2	*	0.50	*	
Alligator snapping turtle						1	*	1.10	*	1
Snapping turtle	2	*	1.1	*	1	9	0.1	7.20	0.1	1
Mud-musk turtle (family)	17	0.4	2.7	0.1	2	17	0.2	3.90	0.1	1
Emydine turtles (family)	13	0.3	4.7	0.1	1	25	0.3	16.20	0.2	
Map turtles						2	*	3.00	*	1

APPENDIX B

(Continued)

	Summerville IV					Mississippian				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
<u>REPTILES</u> (Continued)										
Cooter/Slider/Map turtle	26	0.5	19.2	0.4		23	0.2	30.70	0.4	
Cooter/Slider	4	0.1	6.4	0.1	1	4	*	28.10	0.4	
Painted turtle						1	*	4.20	0.1	1
River cooter						1	*	0.50	*	1
Pond slider										
Box turtle	15	0.3	14.9	0.3	3	28	0.3	31.30	0.4	2
Chicken turtle	2	*	3.6	0.1	1	4	*	1.70	*	1
Softshell turtles (family)	22	0.5	7.3	0.1	1	68	0.7	35.30	0.5	1
Smooth softshell										
Total Identified Turtle	101	2.1	59.9	1.2		185	1.9	163.70	2.2	
Unidentified Turtle	318	6.7	78.0	1.5		562	5.8	97.90	1.3	
GRAND TOTAL TURTLE	419	8.8	137.9	2.9		747	7.7	261.60	3.5	
Non-poisonous snakes	10	0.2	1.1	*		16	0.2	1.50	*	
Water snake						1	*	0.20	*	1
Garter/Ribbon						1	*	0.10	*	1
Black racer	6	0.1	0.7	*	1	3	*	0.70	*	1
Coachwhip	1	*	0.1	*	1	1	*	0.10	*	1
Black racer/Coachwhip	2	*	0.2	*		1	*	0.10	*	
King/Milk snakes										
Rat snakes						1	*	0.10	*	1
King/Milk/Rat snakes	5	0.1	0.9	*	1	3	*	0.30	*	
Mud snake										
Poisonous snakes (family)	10	0.2	2.8	0.1		8	0.1	1.60	*	
Copperhead/Cottonmouth	1	*	0.3	*	1					
Rattlesnake						1	*	0.90	*	1
Total Identified Snake	35	0.7	6.1	0.1		36	0.4	5.60	0.1	
Unidentified Snake	9	0.2	2.8	0.1		7	C.1	0.80	*	
GRAND TOTAL SNAKE	44	0.9	8.9	0.2		43	0.5	6.40	0.1	
Lizard	1	*	.1	*	1	1	*	0.03	*	1
GRAND TOTAL REPTILE	464	9.8	146.9	3.1		791	8.2	268.03	3.6	
<u>AMPHIBIANS</u>										
Amphiuma	5	0.1	0.7	*	1	3	*	0.60	*	1
Frog	1	*	0.5	*	1					
Frog/Toad	1	*	0.1	*		3	*	0.50	*	1
Salamander										
GRAND TOTAL AMPHIBIAN	7	0.1	1.3	*		6	0.1	1.10	*	

APPENDIX B

(Continued)

	Summerville IV					Mississippian				
	Ct.	%	Wt.	%	MNI	Ct.	%	Wt.	%	MNI
FISH										
Gar (family)	9	0.2	2.00	*	2	8	0.1	1.10	*	3
Longnose gar	1	*	9.20	0.2	1	3	*	0.60	*	2
Spotted gar	1	*	0.40	*	1					
Alligator gar						1	*	0.40	*	1
Bowfin	5	0.1	0.70	*	3	17	0.2	2.22	*	9
Shad/Herring (family)										
Grass pickerel										
Sucker (family)	5	0.1	0.40	*		6	0.1	0.47	*	5
Smallmouth buffalo										
Redhorse	3	0.1	0.70	*	2	5	0.1	0.62	*	2
River redhorse										
Golden redhorse										
Catfish (family)	2	*	0.50	*		27	0.3	3.21	*	4
Catfish (Ictalurus spp.)	2	*	0.20	*	2	4	*	0.33	*	
Blue catfish	1	*	1.20	*	1	1	*	0.08	*	1
Channel catfish						17	0.2	8.80	0.1	10
Blue/Channel catfish						11	0.1	3.20	*	6
Brown bullhead										
Madtom						5	0.1	0.33	*	3
Flathead catfish	4	0.1	5.80	0.1	3	3	*	0.60	*	2
Sunfish (family)						7	0.1	0.56	*	5
Bluegill (Lepomis spp.)						5	0.1	0.28	*	4
Bass	1	*	0.10	*	1	9	0.1	1.28	*	7
Crappie						1	*	0.09	*	1
Drum	18	0.4	6.80	0.1	11	41	0.4	9.71	0.1	20
Total Identified Fish	52	1.1	28.00	0.6		171	1.8	33.88	0.5	
Unidentified Fish	79	1.7	11.16	0.2		263	2.7	24.82	0.3	
GRAND TOTAL FISH	131	2.8	39.16	0.8		434	4.5	58.70	0.8	
Total Identified Bone	4752	100.0	4738.36	99.9		9625	100.0	7494.43	100.1	
Unidentifiable Bone	2705		411.80			4998		485.32		
GRAND TOTAL BONE	7457		5150.16			14623		7979.75		

APPENDIX C

Estimated Fish Weights per Cultural Period

Species	Middle Miller III		Summerville I		Summerville II-III		Summerville IV		Mississippian	
	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.
Lepisosteus spp					0.82	1	0.96	1	0.82	1
							1.36	1	1.20	1
									1.36	1
L. osseus					3.18	1	4.55	1	0.63	1
					4.55	1			1.20	1
L. oculatus					0.32	1	0.50	1		
L. spatula					22.72	1			11.36	1
Amia calva	0.46	1	0.68	1	0.46	1	0.68	1	0.23	1
	0.68	1	0.91	1	1.06	1	1.36	2	0.81	1
	0.91	2	1.82	1	1.82	3			0.91	2
	0.93	1			2.73	1			1.36	1
	1.14	1							1.50	1
	1.36	1							2.72	1
	2.73	1							2.73	1
									3.19	1
Clupeidae	0.28	1	0.28	1						
Esox americanus	0.22	1			0.20	1				
Cyprinidae	0.01	1								
Catostomidae									0.17	1
									0.40	2
									0.59	1
									0.86	1
Erimyzon spp.	0.36	1								
	0.40	1								
Ictiobus bubalus			6.36	1	0.91	1				
Moxostoma spp.	0.17	1			1.36	1	0.65	1	0.86	2
					1.70	1	1.70	1		
M. carinatum					2.72	1				
M. erythrurum					0.86	1				

APPENDIX C

(Continued)

Species	Middle Miller III		Summerville I		Summerville II-III		Summerville IV		Mississippian	
	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.
Ictaluridae	0.01	1			0.08	1			0.03	1
					0.12	1			0.12	1
					1.03	1			0.71	1
									1.36	1
Ictalurus spp.	0.18	1	0.71	1	0.04	1	0.71	1		
	0.37	1			1.03	1	1.03	1		
I. furcatus			0.37	1	1.36	1	3.41	1	0.49	1
					3.60	1				
I. punctatus	0.04	1			0.26	1			0.12	1
	0.08	1							0.37	2
	0.12	1							0.42	1
	0.71	1							0.49	1
	2.78	1							0.71	3
									1.36	1
									3.41	1
I. punctatus/furcatus	0.80	1			0.26	1			0.71	1
					0.37	1			0.90	1
									1.03	1
									2.78	1
									3.60	1
									6.62	1
I. melas	0.04	1								
	0.08	1								
	0.12	1								
	0.15	1								
I. natalis	0.01	1								
I. nebulosus	0.04	1			0.03	1				
					0.12	1				
Noturus spp.	0.01	1							0.03	1
									0.12	1
									0.15	1
Pylodictis olivaris	0.12	1	1.36	1	0.71	1	0.18	1	0.26	1
							1.03	1	3.61	1
							11.36	1		
Morone mississippiensis	0.50	1								

APPENDIX C

(Continued)

Species	Middle Miller III		Summerville I		Summerville II-III		Summerville IV		Mississippian	
	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.	Est. Weight (kg)	# Ind.
Centrarchidae	0.01	1			0.73	1			0.05	1
	0.13	1							0.26	1
	0.17	1							0.41	1
									0.44	1
									1.04	1
<u>Lepomis</u> spp.	0.04	1							0.05	1
	0.05	1							0.11	2
	0.07	1							0.17	1
	0.11	1								
	0.17	1								
	0.26	1								
<u>Micropterus</u> spp.	0.05	1			0.25	1	1.04	1	0.15	1
	0.15	1			0.73	1			0.25	1
	0.25	1			1.04	1			0.30	1
	0.41	2							0.41	2
	0.52	1							0.73	1
	0.73	1								
<u>M. salmoides</u>									0.73	1
<u>Pomoxis</u> spp.	0.03	1			0.44	1			0.54	1
	0.13	1								
	0.16	1								
	0.19	1								
<u>P. annularis</u>	0.44	1								
Percidae	0.28	2								
<u>Stizostedion vitreum</u>	0.69	1								
<u>Aplodinotus grunniens</u>	0.46	1	0.03	1	0.03	2	0.22	1	0.16	1
	0.53	1	0.22	1	0.08	1	0.32	1	0.22	6
	0.80	1	0.32	1	0.22	1	0.46	1	0.32	1
	1.66	1	5.90	1	0.46	2	0.49	1	0.46	2
	5.90	1			0.60	1	0.60	3	0.49	1
					1.02	1	1.90	1	0.60	2
							2.73	1	1.02	2
							5.90	1	1.35	1
							10.00	1	1.66	3
									2.73	1
Total Weight (kg)	31.80		18.96		64.15		55.70		87.93	

APPENDIX D

BONE ARTIFACTS

Anne Woodrick

Although tens of thousands of bone fragments were recovered from the Lubbub Creek Archaeological Locality, only 26 of these had been modified and can be considered artifacts. When possible, these artifacts were assigned a functional label based on their similarity to previously described bone artifacts from archaeological sites in the Eastern Woodlands and to bone tools discussed in the Southeastern ethnographic literature. At times such designations may be misleading, so an attempt has been made to portray as thoroughly as possible each artifact and group of artifacts.

The bone artifacts were grouped in terms of their cultural and chronological associations. However, no great importance should be attached to the assemblages of bone tools that resulted from this grouping. Many of the bone artifacts described here were found in Archaic, Woodland, and Mississippian sites, and, given the few bone artifacts found in the Lubbub Creek Archaeological Locality, the construction of "tool kits" would not be warranted under any conditions.

Artifacts from Proveniences with Mixed Cultural Associations

One artifact, USN 9337, was not associated with debris from a specific archaeological phase. This object was found in a midden whose contents included both Wheeler Series fiber tempered and Mississippian shell tempered sherds. The artifact (Figure 1) was 63.5 mm long, 21.0 mm across at its widest point, and 1.9 mm thick. The implement appeared to have been carefully cut from an animal bone that had a flat surface (e.g. a deer scapula or rib). Its surface was slightly polished. Considering the general provenience in which the item was located and that no references to similar artifacts were found in either the archaeological or ethnographic literature, this artifact was not assigned to a functional category.

Late Woodland Artifacts

Only two bone artifacts, a fishhook and a modified long bone diaphysis of a small mammal, were associated with Late Woodland debris (Table 1). These artifacts were found in pit features located in the southwestern portion of Hectare 300N/-300E. Both items were burned and broken. Because of the color changes that result when a bone has burned, it was not possible to determine whether or not these artifacts had been broken prior to excavation.

The bone artifact from USN 1747 was a mid-shaft section of a long bone that probably belonged to a species of small mammal. The long axis of one

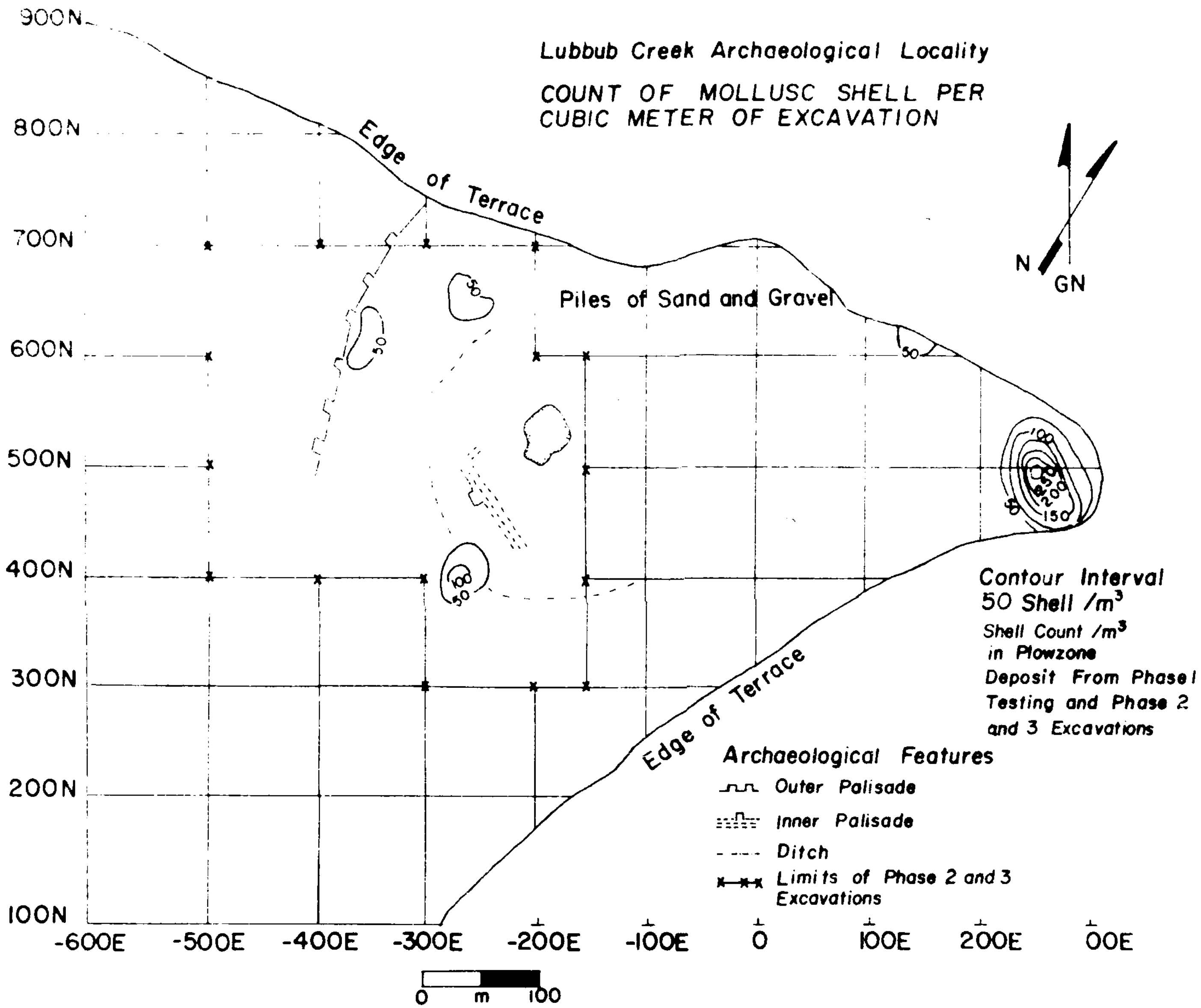

Fig. 1. Distribution of molluscan remains from the Lubbub Creek Cutoff Locality based on the count of valves/m^3 in the plowzone samples.

ation of the Phase I auger tests only a general outline of the pH values in the excavation area could be constructed. Such generality makes the pH factor of little use in selecting specific excavation units for analysis.

The selection of units which contained large numbers of bivalves was based on (1) the site surface map of count of mollusc shell per m^3 in the plowzone samples, and (2) the initial laboratory tabulations of the counts and weights of bivalves remains. The distribution of shell refuse in the plowzone (Figure 1) indicated two potential areas from which to select subsurface excavation units. However, the eastern area, located in hectares 400N/200E and 500N/200E, was situated outside of the area that was excavated in Phases II and III. The second area lay in the northern part of hectare 300N/-300E and the adjacent southern portion of hectare 400N/-300E. Four 10 by 10 meter test squares were located in the high shell density area and a number of pit features were excavated.

The surface distribution of shell count does not necessarily indicate that features delineated below the plowzone will contain dense concentrations of shell refuse, but it does provide a rough guide to the distribution of such remains. What is crucial to locate are excavation units which have a high density of shell remains in proportion to the amount of excavated fill. Shell strata within pit features and shell concentrations in the midden tend to contain this desired high density of bivalves in relation to excavated fill. In addition, the shell valves in these units are usually well-preserved. The initial laboratory tabulations were used to select Unit Serial Numbers (USN) which had high mollusc count and weight values, preferably those USN units recorded as shell strata or concentrations.

Postmold and burial fill did not contain sufficient molluscan remains per unit to justify being considered for analysis. Approximately nine percent of the postmolds (362 out of 3984) and 44 percent of the burial units (19 out of 43) contained some mollusc refuse remains. The amount of shell debris per postmold unit (mean count = 0.76, s = 20.97; mean weight = 5.6 gm, s = 172.3 gm) and shell debris per burial unit (mean count = 6.28, s = 24.49, mean weight = 27.65 gm, s = 114.82 gm) was minimal. Therefore, since assigning postmold and burial fill to specific archaeological phases is often difficult, these two excavation unit types were not included in the selection of possible units for invertebrate analysis. Freshwater mussels found in postmold fill, however, may have occasionally served as post supports. An argument for this particular utilization of naiad valves will be presented later in this chapter.

Considering, then (1) excavation units from the region of the site where the shell count in the plowzone was the highest, (2) units referred to as shell concentrations in the midden (four of these were excavated), (3) pit features with shell strata, (4) excavation units which contained a weight of 500.0 or more grams of shell, and (5) units assignable to a specific archaeological period or phase (Middle Miller III, Summerville I, Summerville II-III, and Summerville IV), 45 pit features units, two structure units, one shell concentration unit, one postmold unit, and five midden units were selected for intensive analysis (Table 1). Pit features were the preferred sample units because their fill usually contained ceramics that were characteristic of a particular archaeological phase. Six pits, which initially were considered to be assignable to a specific Summerville period,

resource. However, in addition to providing dietary information, the analysis of these bivalves is useful in the reconstruction of prehistoric environments. For example, once the identification of these naiad species is known, then it is possible to ascertain the aquatic habitat from which the shells were gathered (Matterson 1958, 1960). Any temporal changes either in the relative amounts of shellfish gathered in relation to other food resources or in the proportions of the specific mollusc species gathered may be useful in hypothesizing changes in either the exploitative strategies of prehistoric groups or the environment surrounding the site.

Some of the molluscan valves from the site have been altered for utilitarian and ornamental purposes. A discussion at the end of this paper will focus on these shell artifacts. The species of mollusc chosen for artifacts, the types of artifacts made, and the probable manufacturing process will be described.

FRESHWATER MUSSELS: SAMPLING AND IDENTIFICATION PROCEDURES

Pelecypods comprise almost all of the molluscan remains which were excavated at the Lubbub Creek Archaeological Locality.[20] A total of 53,438 freshwater mussel shells (Table 2) were found in the fill from pit features, burials, and postmolds and from structure and midden excavation units. Of the 804 excavation units which contained some mollusc shell, 54 units (6.7 percent) were chosen for identification and analysis. These units contained a total of 12,569 valves which constituted a 23 percent sample of the total count of bivalves. Excavation units were selected so that the greatest amount of information pertaining to mollusc exploitation during particular archaeological periods could be analyzed. The major criteria in selecting specific units for analysis were: (1) the preservation of the mollusc valve; (2) the number of valves within a particular unit; and (3) the temporal significance of the ceramics associated with the excavation unit.

The preservation of the bivalves from the site varied from solid, complete valves to powdery, flaky shells on which the interior and exterior features had been totally destroyed. Mollusc shell generally will be preserved best in those excavation units where large numbers of valves were deposited together and subsequently buried. The longer the valves were exposed to the natural elements, the greater the chance is that the features of the shell have eroded. Once the exterior features, such as ridges and pustules, and the interior features, like the form of the pseudocardinal teeth, depth of the beak cavity, adductor muscle scars, and lateral teeth, have been smoothed down or destroyed completely, it is almost impossible to identify the species from what remains of the shell.

Besides exposure to weathering forces, the pH value of the soil can affect the preservation of the mollusc valve. The more alkaline the soil, the better the preservation. The range of soil pH values on the site varied between 4.6 and 6.2. These values were obtained during Phase I testing and were one of the five measures used for the purpose of cross-checking the adequacy of the Phase II and III excavation strategy. However, from the

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[20]Some modified land and freshwater gastropods were contained in the refuse debris, but these shells are not included in this analysis.

CHAPTER 5. MOLLUSCAN REMAINS AND SHELL ARTIFACTS

Anne Woodrick

The freshwater mollusc was one of the riverine resources utilized by historic and prehistoric Native Americans for subsistence, economic, technological, and decorative purposes. Ethnographic descriptions of Southeastern Indian life mention that bivalves and univalves were used as food resources and as raw materials for the manufacture of knives, arrow points, tweezers, beads, gorgets, and pendants (Swanton 1946; Adair 1775). Crushed shell was an aplastic added to clay in the process of making pottery, and the sharp edges of a shell were sometimes used by potters to shape and decorate their vessels (Swanton 1946:252). Swanton (ibid.:498) also recorded that a mixture of shell ash and hot water was the customary way that body hair was removed by the Acolapissa tribe of southeastern Louisiana. Archaeologists who have analyzed molluscan remains from prehistoric sites have shown that besides being a supplementary food resource, the molluscan valves were modified for such items as spoons, scrapers, and rattles (Parmalee et al. 1972; Morse 1963; Black 1967).

In addition to the locally available invertebrates, marine gastropods, primarily the conch (*Busycon* spp.) and a variety of small snail (*Marginella apicina*), were traded extensively throughout the Eastern United States. These univalves were valued as the raw materials for the manufacture of body ornaments, ceremonial paraphernalia, and as a media of exchange. Decorative items such as pendants, masks, ear spools, beads, and gorgets were fashioned from the shells. Strings of shell beads are known to have circulated as a medium of exchange (Adair 1775:169), and historically this shell money was referred to as Peak, Wampum or Roanoke (Lawson 1860:315). In pre-colonial times, a conch shell cup was used to serve the "black drink" of the Southeastern Indians. This drink was consumed during village ceremonies in which only the male members of the society participated (Lewis and Kneberg 1954:68; Hudson 1979).

Potentially, then, molluscan invertebrates could have been used for a wide variety of purposes by the prehistoric Native Americans. The identification and analysis of invertebrates from sites can be very informative about certain aspects of prehistoric life. In the interior of the Southeast marine shells can be used as a measure of external exchange. In the same area, freshwater molluscan refuse can be analyzed as food remains, as potential raw materials for tools and ornaments, and as indicators of bygone riverine habitats.

At the Lubbub Creek Archaeological Locality large numbers of freshwater mussels comprised part of the refuse debris excavated during the 1978-1979 field season. These bivalves probably were collected primarily as a food

tended to cluster in three areas of the site: the mound, the northeast corner of hectare 500N/-400E, and the northeast corner of hectare 400N/-400E and the adjacent northwest corner of hectare 400N/-300E. They also tended to be associated with specific types of excavation units: burials and features associated with structures. Six artifacts (26 percent) were associated with human burials, seven artifacts (30 percent) were found in the area around the mound, another seven items (30 percent) were located in features surrounding structures, and three objects (13 percent) were isolated instances of an awl associated with the debris from a pit feature.

The objects located in the area of the mound include the rarer types of bone artifacts (the chisel and projectile point), artifacts made from animals which were not typically found in the village refuse (Lynx rufus), and ornamental artifacts (pin) usually associated with burials. Scott (this chapter) identified several species of birds whose remains were located only in the mound area. Individuals who lived near the mound, or those persons who had access to the mound, may also have had privileges in the utilization of certain animal bones and certain types of artifacts.

The bone artifacts found in features adjacent to structures were all bone awls. A relationship between the location of bone awls with structures, awls either directly from a house unit or from the immediate vicinity of the house, has been proposed by several authors (Webb and DeJarnette 1942:123; McGregor 1958:137; Winters 1969:51). Awls were probably utilized in tasks which were normally carried out by family members near their living quarters. Both the sturdier large mammal awls and the turkey bone awls were located in the vicinity of the structures.

In conclusion, bone and antler artifacts were not common in the Lubbub Creek Archaeological Locality, nor for that matter were they abundant at other prehistoric sites in the immediate region (Curren 1979). It may well be that other raw materials (such as cane) were more accessible and more suitable for the manufacture of certain items. Despite the small number of artifacts, the artifacts that were found exhibited a variety of functions. These include perforators, fishhooks, projectile points, chisels, pins, and pendants. Bone pins were usually associated with burials, awls were most commonly distributed near house floors, and the artifact made from either rare animal species or those of unusual form occurred in the vicinity of the Mississippian mound.

the nine known drilled black bear canines found on sites in the Gainsville Lake area (Curren 1979; this report), seven were in burial contexts and two were associated with pit feature refuse.

One beaver incisor from the site (Figure 1) had been modified, and the resulting tool was probably hafted to function as a chisel. During the manufacturing process the lingual surface of this tooth was cut away, and, as a consequence, heavy incisions can be seen on the peripheries of the inner surface. These cutting marks paralleled the long axis of the tooth, and the bone surface near these longitudinal striations was smoothed and polished. The anterior tip of the tooth was slightly concave (0.9 mm deep), which was probably the result of heavy use. The anterior edge of the tooth, the "bit," had fine notches along its entire length. Several use wear striations began at the tip of the lingual surface and extend posteriorly to the cavity created by the removal of the lingual section of the tooth. No wear patterns could be observed on the labial surface of the tooth.

The beaver incisor artifact was excavated from near the ramp of the mound. One other beaver incisor chisel found in the Lubbub Creek Archaeological Locality was located with a Mississippian burial (Curren 1979:216). Modified beaver incisors, referred to as chisels, have been found on many archaeological sites in the Eastern Woodlands. Winters (1969:57) considers these artifacts to be woodworking or boneworking tools that male members of the society used to make weapons and other wooden and bone items. Swanton (1946:272) also documents the use of beaver incisors as tools used by Native North Americans in the manufacture of their arrows.

One artifact was manufactured from the right anterior portion of a completely fused box turtle carapace. This carapace fragment (Figure 1) had been cut intentionally at a diagonal along a suture line from the middle of the fifth right peripheral to the middle of the medial portion of the second right pleural. The other edges of the bone had broken unevenly, both recently and in the past, indicating that only part of the original artifact was intact. A perforation was drilled from the interior surface through the middle of the second right peripheral. This hole began as a square incision and ended as a circular hole on the outer bone surface. The diameter of the perforation, when measured on the exterior surface, was 2.0 mm. The carapace artifact was associated with a female burial and may have served as either a pendant or other ornamental item.

DISCUSSION

All of the bone artifacts found in the Lubbub Creek Archaeological Locality were manufactured from the skeletal parts of animals that were locally available to the inhabitants of the site. The majority of these artifacts were fashioned from the bones of animals whose remains were abundant in the refuse debris: *Odocoileus virginianus* and *Meleagris gallopavo*. Only a few were made from those animals whose remains were either rare or absent in the village refuse, namely *Ursus americanus*, *Lynx rufus*, and *Castor canadensis*. These artifacts may have been considered more significant since they were generally found in either burials or near the mound.

The Mississippian bone artifacts were not evenly distributed throughout the excavated area of the Lubbub Creek Archaeological Locality. Instead, they

lithic pressure flaking process.

The other antler tine fragment was a projectile point (Figure 1). The point was 30.4 mm long and 1.7 mm thick, the latter measurement indicating the thickness of the barb. The inner core of the antler tine had been reamed out. About one-third of the point had broken away leaving just one barb intact. It was not possible to determine how many barbs the point originally had. The tip of the point does not seem to have been sharpened, but it does show evidence of battering. The projectile point was found in the area near the mound.

A few of the arrows used by the historic Indians in the Southeast were known to have been tipped with deer antler points (Swanton 1946:571). Archaeological examples of deer antler points are known from sites dating as early as the Archaic period (Webb and Dejarnette 1946:229). Some of the Archaic antler projectile points may have been used as atlatl darts. Although McGregor (1958:141) argues that reamed-out antler tine points should be considered atlatl dart points, he goes on to note that the points would have been very ineffective in slaying game animals. Regarding "antler tines with conically socketed bases, tanged or untanged" as projectile points, Winters (1969:45) concludes that such objects also may have been recreational equipment.

Two modified mammalian canine teeth were part of the bone artifact assemblage. One of these, USN 3586, was a canine root fragment from a medium-sized carnivore. The tooth had a jagged, broken edge (it does not appear as though the tooth had been cut intentionally during the manufacturing process), and the entire crown portion of the tooth was missing. The remaining surface of the artifact was polished. Four or five thin sections of the outer surface of the tooth were shaved from the posterior one-third of the root. A narrow groove was located on one side of the root, at a point near that where the thinning process began. This tooth was contained in the debris from level one of an extension in the north central part of Hectare 500N/-400E. The artifact was not assigned to a functional group, although it is most likely that such an item had been modified for ornamental use.

The other dental artifact was a canine tooth from a black bear (Figure 1). This mandibular tooth was perforated biconically near its apex. The inner diameter of the perforation measures 4.0 mm. An old break in the tooth was located at the point of the perforation; as a result, the posterior tip of the tooth was missing. In addition, a crack extended the length of one lateral side (from the perforation to the anterior tip) and continued up the anterior one-third of the opposite side. More than half of the tooth's enamel had chipped off. This artifact was associated with the refuse from a Summerville IV pit feature.

The black bear was commonly hunted by the historic Southeastern Indians (Swanton 1946:249). However, postcranial elements of this species are not found often in refuse debris because this animal was given special attention by Native North Americans (Hallowell 1926). Modified cranial elements were often included in material excavated from prehistoric sites as Parmalee, Paloumpis, and Wilson point out: "The recovery of worked canine teeth and cut jaw and skull sections of the black bear is a common occurrence and occasionally these artifacts are recovered as part of burial complements." Of

functions are equally likely. Webb and Dejarnette (1948:58-59) suggest that pointed turkey long bone objects may have served either as awls or hairpins. Webb (1946:285-286) considers the bird bone "awls" from the Indian Knoll Site in Kentucky to be too thin and fragile to have functioned as perforators. He contends that they were better suited for use as clothing pins, hair pins, or skewers. The cooking function is supported by the fact that many of the bird bone awls from the Indian Knoll Site had been damaged by fire and were associated with ash beds where cooking fires were located (ibid). Winters (1969:50-51) dismisses the idea that bird bone awls were used as clothing or hair pins, but agrees with Webb's supposition that some "awls" did indeed function as skewers. Only one of the turkey tarsometatarsus bone tools from the Lubbub Creek Archaeological Locality was burned, which does not lend much support to the meat skewer hypothesis. However, no other function can be as easily attributed to these artifacts.

Another group of pointed bone artifacts was not assigned a utilitarian label, but was designated as ornaments or "pins" (Figure 1). A total of five specimens was identified as pins, and these items were associated either with burials or the mound area. Four of the pins were manufactured by the same process: apparently a shaft fragment from a relatively straight long bone of a large mammal was ground down (or cut and then ground) until the manufacturer produced an object that had blunted ends, was circular in cross-section, and tapered slightly toward one end. The only complete specimen, USN 4588, was 49.0 mm long, 4.1 mm in diameter at the thicker end, and 3.4 mm in diameter at the other end. None of the four pins had any use wear striations.

Two bone pins (USN 2893) were associated directly with copper ear spools which, in turn, were lying next to the temporal bones of the skull of an adult male skeleton. This context suggests that the artifacts may be designated "pins." Neither of the two pins was well preserved; they could not be measured nor was it possible to determine if they were ever polished. The other two pins (USN 4588 and USN 4077) were polished. One of them was found in the fill surrounding an infant burial; the other was found in Midden I near the mound.

The fifth pin differed from the others in that it could be identified as a mid-shaft bone fragment (probably a fibula) from a large bird. This pin had not been ground into shape, nor was it polished. It was 44.4 mm long and 1.3 mm in diameter. During excavation this artifact was found lying over the ribs of the infant; the pin possibly could have functioned to fasten a wrap around the child's body.

The remaining Mississippian artifacts could not be combined into groups like the ones described above for bone awls and pins. Instead it was necessary to describe each one as an example of a distinct artifact. Two types of artifacts were made from the distal portion of an antler tine. One of these, USN 4132, was found in the fill around a female burial. The tool was quite small, only 22.6 mm in length, and it was broken on the proximal end. The break was an old fracture indicating that the breakage probably occurred prehistorically. The only modification made to the tine was the removal of a section of the distal end, which resulted in a wedge-shaped, blunted tip. The antler fragment resembled a miniature shoe tree. Along the distal edge of the antler were a series of microscopic notches. This object has been tentatively referred to as an antler drift, an implement used in the

TABLE 2

Measurements Taken from 6.0 mm from the Bit on Certain Bone Awls.

USN	Width	Thick- ness	Species
5082	2.5 mm	4.4 mm	_Meleagris gallopavo_
8145-8174	2.6 mm	4.3 mm	_Meleagris gallopavo_
8972	2.5 mm	4.4 mm	mammal or bird
3594	2.2 mm	4.5 mm	mammal or bird
3619	2.3 mm	4.4 mm	mammal or bird
$\bar{X}$ =	2.42 mm	4.4 mm	

These features were located quite close together; only 1.2 m separated the center points of the features.

The third turkey bone awl, USN 5082, was just a small fragment of a right tarsometatarsus. Only the bit portion of the artifact remained; it was broken 24.7 mm from the tip. The surface of this awl was polished, but no use wear striations were discernible.

Three other awl tip fragments, USN 3619, USN 3594, and USN 8972, were made from either mammal or bird bones. All of the broken bits were polished, and no wear incisions could be observed on any of the awl fragments. The smallest fragment, USN 8972, was 6 mm long, 4.4 mm wide, and 2.5 mm thick. Measurements (width and thickness) were taken at a point 6 mm from the tip on all of the awls thought to have been made from the long bone of a turkey. These measurements (Table 2) are all quite similar. Although not with certainty, it is believed that these awl fragments were made from the long bones (probably the tarsometatarsus) of a large bird (probably a turkey).

The final artifact in this group, although labelled an awl, should possibly be considered non-utilitarian. This artifact, USN 4517 (Figure 1), was a right ulna from a bobcat. The distal one-fourth of this bone was missing and the shaft had been shaped into a blunt point. A small piece of the diaphysis along the medial side near the bit was broken off, probably prehistorically. The surface of the bone had a dull sheen, which extended from the bit to the radial notch. Incisions, resulting from either wear or manufacturing, were not present. The awl was associated with debris excavated from a 10 by 10 m square located along the western edge of the mound near the ramp. This ulna awl is the only known bobcat bone artifact from the Central Tombigbee Valley.

Swanton (1946:250) notes that the Southeastern Indians occasionally would eat "wildcat" (bobcat) and that the skins of this animal were worn as clothes. In addition to the utilitarian value of the animal, Parmalee, Paloumpis, and Wilson (1972:43) recognize that some carefully modified skeletal parts of the bobcat (most often skull and mandible) found in archaeological sites in the Eastern Woodlands are indicative "of a cultural trait that goes beyond strictly economic utilization of the animal." The location of this artifact near the mound, its overall rarity in the region, and the lack of use wear suggest that the bobcat ulna was made for a special purpose.

All of the above artifacts were described as awls because only one end of the artifacts was pointed and utilized and because the use wear striations, when discernible, were parallel to the longitudinal axis of the bone. Lumping these tools together and labelling them all awls suggests that they were used to punch holes in wood, hides, and other material. This presumed functional implication of the name "awl" may be misleading, however. Large mammal long bone awls may also have been used for sewing and basket coiling (Kroeber 1925:822). Ulna awls with long and thin points were associated with both these tasks. Blunter awls, such as the awls from the Lubbub Creek Archaeological Locality, were cited as implements used to dress fish (ibid).

The deer ulna awls and large mammal long bone splinter awls would have made much sturdier tools than awls manufactured from the long bone of a turkey. Although it is possible that bird bones were perforators, other

longitudinal axis of the bone. These incisions were concentrated below the radial condyle.

The other ulna awl was broken below the radial condyle. The bit of the awl, like the ulna awl above, had been sharpened by grinding and cutting down both the anterior and posterior surfaces of the bone. The fragment was well polished. Although some longitudinal use wear striations could be observed under the microscope, these incisions were neither as deep nor as numerous as those on the first ulna awl described above.

Three splinter bone awls were identified. These bone fragments were most likely the by-products of cracking long bones for the extraction of bone marrow. They were chosen for further modification because of their desirable size and shape. Two of the bones splinters, USN 2322 and USN 2510 (Figure 1), had been sharpened intentionally on one end. The awls were of approximately the same length, 44.0 mm and 38.3 mm respectively. The former splinter would have made an oval perforation. Its surface was polished, and use wear striations ran parallel to the long axis of the long bone. The latter artifact had a triangular cross-section. The outer surface of most of this artifact was not preserved; therefore, it was not possible to determine the extent to which the awl was polished and used. The third long bone splinter awl, USN 8158, had been utilized without undergoing modification by intentional sharpening. The pointed end of the splinter had a triangular cross-section. A series of small, evenly worn notches can be seen along the edges of the pointed end. These microscopic notches probably are the result of use. However, no use wear striations can be observed on the surface of the bone, and the bone is not polished.

Three other bone awls definitely could be identified as having been manufactured from the tarsometatarsus of a turkey. One of these bone awls, USN 4541 (Figure 1), was the proximal portion of a left tarsometatarsus, the distal end of which had been broken. On one of the lateral sides of the long bone, beginning just below the distal opening of the hypotarsal canal, an oblique cut was made which removed the entire lateral side of the bone. The lateral edges were smoothed. A sharply pointed bit was fashioned on the medial side of the bone. The surface of the artifact was polished, and use wear striations extended the length of the longitudinal axis. A natural perforation in the long bone, the hypotarsal canal, was located at the proximal end.

Two pieces of the same right tarsometatarus awl came from two separate pits. One part of the awl, USN 8145, came from pit feature 146. It was made from the mid-shaft section of the bone, and the proximal end was gnawed by a carnivore. The distal end of the shaft fragment articulated with a sharply pointed bone piece, USN 8174, which came from pit feature 152 (Figure 1). The manufacturing techniques used to make this artifact were the same as those described above for USN 4541. In addition, the use wear patterns and polishing of the two artifacts were very similar.

The dirt-free, broken edges of the awl indicated that the artifact had been fractured recently. This observation precludes the possibility that the artifact broke prehistorically and was discarded into different pit features. Instead, the awl was probably cast into one of the two pits and broken and dragged by the plow or backhoe when the overburden was removed from the unit.

side of the bone was relatively flat; the other three sides of the diaphysis formed a continuous curve. Several heavy use-wear striations running parallel to the long axis of the bone were located on three-fourths of the artifact's surface. Only the portion of the shaft that was directly opposite the flattened side did not show evidence of use. On one side of the bone, beginning approximately 8 mm from a broken end, a V-shaped section of the shaft was cut away. This cut might have been made to form a point further down the shaft. The entire surface of the bone has a very high polish, which could be the result of burning, use, or a combination of both. The longitudinal wear pattern on this artifact suggested that the bone might have been used in an activity such as sewing. In this case, the implement could have functioned as either a needle or a perforator. However, because so little of the tool was preserved, this artifact was not assigned to a functionally defined category.

The other Middle Miller III bone artifact was a broken fishhook. Although it is not certain if this object was made from bird or mammal bone, the size, thickness, and curvature of the bone was most like a long bone from a large bird, probably a turkey. The fishhook fragment was 14.7 mm long and 5 mm wide. This artifact had incisions along its sides which ran parallel to the long axis of the bone. It also was apparent that a slot was cut out of the shaft from the exterior surface of the bone. This manufacturing technique is similar to the prehistoric fishhook manufacturing process described by McGregor:

> First a splinter of bone was ground down on the sides until they were parallel, and the ends were incised and broken off or cut through. The ends were then ground down to a somewhat rounded outline, and a section of bone was incised through and broken out of the middle, to produce a somewhat link-shaped object. This was then cut through one side, and incised and broken on the other, to produce two regularly hook-shaped objects. These were then ground to points, and the finished hook was achieved. (1958:148-149)

Webb and Dejarnette (1948:60-61) discuss a slightly different fishhook manufacturing process in which a fishook and bifurcated bone splinter are produced instead of two hook-shaped objects. Scott (see above) discusses the prehistoric fishing methods utilized by the inhabitants of the Lubbub Creek Archaeological Locality.

<u>Mississippian Artifacts</u>

The most numerous Mississippian bone artifacts were awls. These items came from a wide assortment of excavation units: pit features, postmolds, the mound area, and midden zones. Two of the awls were made from the ulnae of large mammals. One of these, USN 1509 (Figure 1), was positively identified as the left ulna from a white tailed deer. The other awl, a broken right ulna, was not complete enough to identify the species from which it came.

The deer ulna awl was 119 mm long, 17.2 mm wide, and 4.6 mm thick; the latter two measurements were taken just below the radial condyle. The shaft of the bone was probably cut in half by the manufacturer. The distal end of the proximal half was then sharpened from the anterior and posterior surfaces. The bone was heavily polished, and use wear striations paralleled the

TABLE 1

Bone Artifacts Found During the 1978-79 Excavations at the Lubbub Creek Archaeological Locality.

USN	Hectare	Excavation Unit	Archaeological Period	Animal Species Element	Artifact(s)
1747	[illegible]ON/-300E	Pit 22, Z-B	Middle Miller III	small mammal, long bone diaphysis	indeterminate
2012	[illegible]ON/-300E	Pit 32, Z-D	Middle Miller III	mammal or bird, indeterminate	fishhook
				Odocoileus virginianus, antler	"drift"
4132	5[illegible]ON/-400E	Burial 3 (female)	Summerville II-III	*Terrapene carolina*, carapace	pendant
				large mammal, long bone diaphysis	2 pins
2823	400N/-400E	Burial 6 (male)	Summerville II-III	large mammal, long bone diaphysis	pin
4077	500N/-400E	Burial 1 (infant)	Summerville I	cf. large bird, cf. fibula	fine pin
				Lynx rufus, right ulna	awl
4517	500N/-300E	10 by 10 Mound	Mississippian	*Castor canadensis*, incisor	chisel
4541	500N/-200E	5 by 5 Mound	Mississippian	*Meleagris gallopavo*, left tarsometatarsus	awl
4542	500N/-300E	Mound	Mississippian	large mammal, ulna	awl
153	500N/-200E	Mound	Mississippian	*Odocoileus virginianus*, antler	projectile pt
4588	500N/-300E	Midden I Mound	Mississippian	large mammal, long bone diaphysis	pin
8972	500N/-300E	Midden I Mound	Mississippian	mammal or bird, long bone diaphysis	awl
2322	400N/-400E	Midden	Mississippian	cf. *Odocoileus virginianus*, cf. right humerus	awl
1509	400N/-400E	Pit 7	Summerville II-III	*Odocoileus virginianus*, left ulna	awl
2510	400N/-300E	Pit O	Summerville II-III	large mammal, long bone splinter	awl
8158	400N/-300E	PM 1689	Mississippian	large mammal, long bone splinter	awl
3594	500N/-400E	Pit 4	Summerville II-III	mammal or bird, long bone diaphysis	awl
3619	500N/-400E	Pit 9	Summerville I	mammal or bird, long bone diaphysis	awl
5082	600N/-400E	Pit 8	Mississippian	*Meleagris gallopavo*, right tarsometatarsus	awl
8145	400N/-300E	Pit 146	Mississippian	*Meleagris gallopavo*, right tarsometatarsus	awl
8174	400N/-300E	Pit 152	Summerville II-III	*Meleagris gallopavo*, right tarsometatarsus	awl
3586	500N/-400E	Extension 1, L-1	Mississippian	medium carnivore, canine tooth	indeterminate
4125	500N/-400E	Pit 14, C-4	Summerville IV	*Ursus americanus*, canine tooth	pendant
9337	400N/-300E	Midden, Stratum 3	Mixed, Broken Pumpkin Ck. and Mississippian	large mammal, indeterminate	indeterminate
				TOTAL ARTIFACTS	26

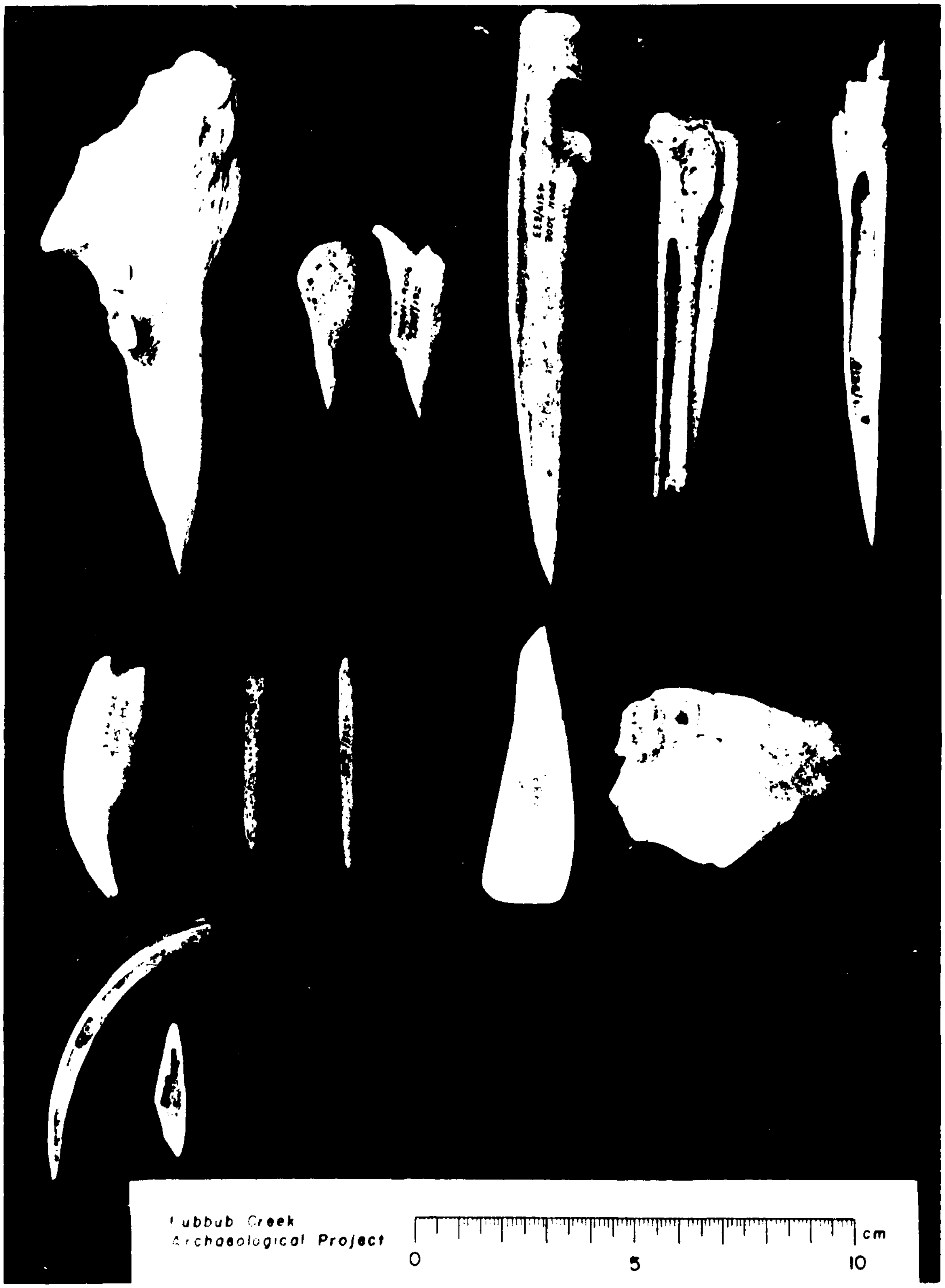

Figure 1. Pictured above are examples of the bone artifacts found at the Lubbub Creek Archaeological Locality. Top row (left to right): Odocoileus virginianus, ulna awl; large mammal, long bone splinter awls; Lynx rufus, ulna awl; Meleagris gallopavo, tarsometatarsus awls. Middle row (left to right): Ursus americanus, canine pendant; large mammal, bone pins; large mammal, indeterminate bone; Terrapene carolina, carapace pendant. Bottom row (left to right): Castor canadensis, incisor chisel; Odocoileus virginianus, antler projectile point.

contain ceramics that are not diagnostic of any particular Summerville period and have been tabulated together under the heading, Mississippian pit features.

A selection of midden units, which could be assigned to the Mississippian period as a whole, was also chosen for analysis. One reason for including these units was to compare the shell refuse found in the midden with the molluscan remains recovered in pit features. It appeared that the shell remains in the midden units were not preserved as well as the shell from the pit features. This observation is based upon the fact that although the percentages of the shell remains by count were nearly equal for pit features and midden units (47 percent and 48 percent of the total count respectively), the percentages of the shell remains by weight for the two groups were very different (Table 2). Fifty-six percent of the total weight of shell was found in the pit features, but only 40 percent of the total weight was from the midden units. One logical explanation for this is that the shell remains in the pit features represented relatively complete shell valves, and shells in the midden areas were less well preserved and more fragmentary. If this is the case, it would support the sampling strategy of analyzing shell remains primarily from the pit features. Of course, it could very well be that different species of shell were represented in two types of units, and the analysis of only one type would have biased the shell sample. Another reason for analyzing midden units is so that a comparison can be made of the shell refuse located in various parts of the site locality. Five midden units (one of these designated as a shell midden) with high shell counts and weights were selected as representatives of five different hectares.

Some of the selected excavation units contained enormous amounts of shell. If a unit contained more than 10,000 gm, then a 10 percent subsample was identified. If a unit contained between 5,000 and 10,000 gm, then a 25 percent subsample was taken. The large units were subsampled by dumping the entire unit of shell onto a large, heavy blanket. Two people then would taken an end of the blanket and alternately would lift and lower their end. This seemed to mix the shell quite well. When the blanket was set down, the circular shell pile separated into three zones: the bottom of the heap contained most of the broken, unidentifiable fragments, above this were small valves, and the largest, heaviest valves were on the top. A wedge-shaped section was removed and weighed. Shells were added or taken away until this desired weight was reached.

The weight and count values recorded in Table 4 for the several archaeological periods represent the sum of: (1) the total weight and count values of all the pit feature units totally identified and (2) the weight and count of the identified subsampled units. Since the total weight and count of the shell remains were known for all the units, the mollusc shell samples, which were identified, could have been used to estimate the total count and weight values of every identified mollusc species associated with a particular archaeological phase. This extrapolation was not made because of the high percentage of unidentified[22] naiad valves that occurred in each sample. These

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[22]Valves referred to in the text as unidentified could not be identified to either a generic or a specific level. In many cases this was because of the poor preservation of the valve. In some instances a valve was considered

TABLE 1

Unit Serial Numbers of the Units Chosen for Mollusc Identification from the Lubbub Creek Archaeological Locality.

USN *Subsampled units	Hectare	Excavation Unit	Archaeological Phase/Period
1600*	300N/-300E	Feature 22	Middle Miller III
1746	300N/-300E	Feature 22, Z-A	Middle Miller III
1747	300N/-300E	Feature 22, Z-B	Middle Miller III
1748	300N/-300E	Feature 22, Z-C	Middle Miller III
1610	300N/-300E	Feature 32	Middle Miller III
2009	300N/-300E	Feature 32, Z-A	Middle Miller III
2010*	300N/-300E	Feature 32, Z-B	Middle Miller III
2011	300N/-300E	Feature 32, Z-C	Middle Miller III
2012	300N/-300E	Feature 32, Z-D	Middle Miller III
2013	300N/-300E	Feature 32, Z-E	Middle Miller III
2014	300N/-300E	Feature 32, Z-F	Middle Miller III
2015	300N/-300E	Feature 32, Z-G	Middle Miller III
2016	300N/-300E	Feature 32, Z-H	Middle Miller III
1799	300N/-300E	Feature 33, Z-A	Middle Miller III
1800	300N/-300E	Feature 33, Z-B	Middle Miller III
1801	300N/-300E	Feature 33, Z-C	Middle Miller III
2182	400N/-500E	Feature 28, Z-A	Middle Miller III
2183*	400N/-500E	Feature 28, Z-B	Middle Miller III
2184	400N/-500E	Feature 28, Z-C	Middle Miller III
2185	400N/-500E	Feature 28, Z-D	Middle Miller III
2186*	400N/-500E	Feature 28, Z-E	Middle Miller III
2187	400N/-500E	Feature 28, Z-F	Middle Miller III
2188	400N/-500E	Feature 28, Z-G	Middle Miller III
3612	500N/-400E	Struc.1, C-2, Daub Zone	Summerville I
3619	500N/-400E	Pit 9	Summerville I
1504	400N/-400E	Pit 1	Summerville II-III
1509	400N/-400E	Pit 7	Summerville II-III
2377	400N/-400E	Pit 28, Z-A	Summerville II-III
2492	400N/-300E	Pit O, C-1	Summerville II-III
2509	400N/-300E	Pit O, C-2	Summerville II-III
2511	400N/-300E	Pit O, C-4	Summerville II-III
3594	500N/-400E	Pit 4, C-3	Summerville II-III
3595	500N/-400E	Pit 4, C-2	Summerville II-III
3596	500N/-400E	Pit 4, C-1	Summerville II-III
3597	500N/-400E	Pit 4, C-4	Summerville II-III
4345	500N/-400E	Pit 31	Summerville II-III
8174*	400N/-300E	Pit 152	Summerville II-III

TABLE 1 (continued)

Unit Serial Numbers of the Units Chosen for Mollusc Identification from the Lubbub Creek Archaeological Locality

USN *Subsampled units	Hectare	Excavation Unit	Archaeological Phase/Period
3459	400N/-300E	Struc.5, C-3, L-2	Summerville IV
4072*	500N/-400E	Pit 14	Summerville IV
4123*	500N/-400E	Pit 14, C-2	Summerville IV
4124*	500N/-400E	Pit 14, C-3	Summerville IV
4316*	500N/-400E	Shell Concentration	Summerville IV
1526	400N/-400E	Pit 4, Z-2	Mississippian
1683	400N/-400E	Pit 10, Z-8	Mississippian
2109	400N/-400E	Pit 16, Z-A	Mississippian
2536	400N/-300E	Pit 8	Mississippian
2858	400N/-400E	Pit 53	Mississippian
8139	400N/-300E	Pit 140	Mississippian
1485	300N/-300E	Postmold 76	Mississippian
1895*	400N/-200E	Shell Midden	Mississippian
2321*	400N/-400E	Midden	Mississippian
3586	500N/-400E	Midden	Mississippian
4588	500N/-300E	Midden	Mississippian
6657	600N/-300E	Midden	Mississippian

TABLE 2

Weight and Count of the Molluscan Remains from the Various Excavation Units at the Lubbub Creek Archaeological Locality.

Excavation Unit	Total Count Shell*	Total Weight of Shell in grams
Pit features	24,197	135,278.0
Structures	2,334	7,249.0
Burials	270	1,189.0
Postmolds	3,028	22,459.0
Midden units	23,609	90,420.0
TOTALS	53,438	256,595.0

*Only bivalves with the pseudocardinal teeth and/or beak cavity were included in the count totals.

unidentified valves presented a dilemma. Were the identified species reflective of the unidentified portion of the mollusc sample so that the percentages of the identified valves could be used to predict the unidentified mollusc? Or were the unidentified species composed of different species of naiads or different percentages of the already identified mussels? Without a better understanding of the species that constituted the unidentifiable group, a conservative approach has been taken in this report. The discussions concerning mollusc exploitation by the various prehistoric populations is based on counts of those species that were identified in the shell samples from each of the several archaeological phases.

The relative abundance of each species during a particular phase is expressed as a percentage of the estimated minimum number of individuals (MNI) which represent each species. The minimum number of individuals is calculated for each mussel species by tabulating separately the numbers of left and right valves. The greater number of valves for either the left or right side determined the MNI for that species. In order to determine the MNI for the unidentified valves it is assumed that these valves should first be used to fill up the discrepancies between left and right totals for each of the identified species. This correction factor is taken into consideration in a formula devised by Michael Wilson which is used to estimate the MNI for unidentifiable valves. The formula is: N¶/2 - T = M¶, where N¶ is the total count of valves, T is the sum of MNI for all identifiable species and M¶ is the MNI for unidentifiable beaks. Species nonspecific (nonspecific is defined in this case to indicate that a generic level identification is possible, but a specific level is not, for example <u>Lampsilis</u> spp.) are treated as unidentifiable beaks within a set representing the same genus and are calculated using the above formula. These set calculations are done prior to determining MNI for the unidentified valves. A nonspecific species may have more valves than the other species in the genus set. In this case, the nonspecific species will be given a MNI and will be included in the calculations for the unidentifiable MNI. This method of calculation explains why some of the nonspecific mussels listed in the tables (Tables 5, 6 and 7) do not have a recorded MNI valve count and others do.

<u>MIDDLE MILLER III FRESHWATER MUSSEL REFUSE</u>

Six out of the seven Middle Miller III pit features which contained some molluscan remains were clustered in the southwestern portion of hectare 300N/-300E. Two of these features, Pits 23 and 25, contained only small amounts of shell, and neither pit was analyzed. The other four features, all of which had large quantities of shell debris, can be described as large, oval, shallow pits with straight sides and flat bottoms. Refuse from these features also included significant amounts of unmodified lithic debris and unmodified rock, which may be indicative of cooking procedures, and will be referred to later. Samples of shell were identified from levels within three of these features: Pit 22, Pit 32, and Pit 33. Preservation of shell in Pit

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unidentifiable because the comparative collection was not adequate for the identification. Relatively complete bivalves not identifiable with the University of Alabama Freshwater Shell Comparative Collection were identified with the assistance of Paul Yokley, Florence, Alabama, Alex Tompa, Ann Arbor, Michigan, and Art Bogan, Philadelphia, Pennsylvania.

TABLE 3

Total Counts and Weights of the Molluscan Remains from Pit Features Excavated at the Lubbub Creek Archaeological Site.

Archaeological Period/Phase	Molluscan Remains		No. of Unit Serial Number Units	No. of Pit Features
	Count*	Weight (grams)		
Middle Miller III	12,900	71,538	32	7
Summerville I	326	2,299	2	2
Summerville II-III	3,896	18,698	24	15
Summerville IV	4,595	30,215	15	10
Mississippian	2,480	12,528	116	99
TOTAL	24,197	135,278	189	133

*Only bivalves with the pseudocardinal teeth and/or beak cavity were included in the total count of shell.

TABLE 4

Count, Weight and Sampling Percentage
of the Freshwater Mussel Shell Identified from Pit Features
at the Lubbub Creek Archaeological Locality.

Archaeological Period/Phase	Freshwater Bivalves		No. of Unit Serial Number Units	No. of Pits	Percentage Sampled By Shell Count
	Count*	Weight (grams)			
Middle Miller III	2,455	24,203	23	4	19%
Summerville I	321	2,276	1	1	98%
Summerville II-III	3,400	15,560	12	7	87%
Summerville IV	1,324	8,041	3	1	29%
Mississippian	976	6,534	6	6	39%
TOTAL	8,476	56,614	45	19	35%

*Only bivalves with the pseudocardinal teeth and/or beak cavity were included in the count of shell.

33 was fair; half of the valves were unidentifiable. In the other two pits, the preservation was better with just 22 percent of the total valve counts considered to be unidentifiable.

The seventh Middle Miller III pit feature, and the fourth from which a sample of shell was taken, was a large, stratified, bell-shaped pit located in hectare 400N/-500E. Two of the seven levels within this feature were shell strata zones, and the remaining zones were almost devoid of shell. The shell was in excellent condition. Only 5.8 percent of the valves could not be identified.

The naiad species present in these pits (Table 5) can provide some knowledge about the types of riverine localities exploited by the Late Woodland population in the Lubbub Creek Archaeological Locality. These data indicate that two molluscan habitats were exploited by this population: one was small streams, the other a large river. In any interpretation concerning the habitat requirements of freshwater mussels it must be understood that these naiads can be very flexible and they can adapt to a wide range of environmental situations. Although a species may have a preference for living in a large river habitat, it also may be present in creeks, and vice versa. In describing the two environmental localities below, the emphasis has been put upon the preferred habitat of each species and on the location where the greatest numbers of each species usually will be found.

The first of the two mollusc procurement locations is a stream habitat similar to Lubbub Creek. This creek enters the Tombigbee River across from the site locality. Two species, Elliptio dilatatus and Villosa lienosa, prefer such a stream environment (van der Schalie 1938, 1939; Yokley 1975). The former species is most often found where a moderate current occurs over a sand or gravel bottom, and the latter species frequently can be collected in shallow water from a sand or mud substrate (Parmalee 1967).

Five additional species can be found commonly in either a creek or a river habitat. Obovaria unicolor, Tritogonia verrucosa, Lampsilis excavata, Lampsilis straminea, and Fusconaia rubida have been recorded as present in creeks located in the vicinity of the site (van der Schalie 1939) and are given as characteristic species for small to medium-sized rivers (van der Schalie 1938). This creek environment, however, was not a prime location for collecting naiads. An infrequent exploitation of creek mussels is reflected in the MNI tally for all seven species. These bivalves comprise only 9.3 percent of the total identified mussels gathered during the Middle Miller III subphase.

A favorable habitat for the majority of the identified mussels collected during the Late Woodland occupations would have been the Tombigbee River which flanks the site locality on three sides. The two species most often procured, Quadrula asperata and Fusconaia ebena, represent 57.5 percent of the identified mussels. These naiad species reach an optimum population size on sand or gravel bars in large rivers where the water is generally shallow and clear and the current is moderate to swift (Parmalee 1967; Yokley 1975). These sand and gravel bars would have been the preferred environment for most of the identified molluscs, especially during the naiad's juvenile stage (Yokley 1975).

TABLE 5

Freshwater Bivalves from a Sample of Middle Miller III Pit Features

Species	Total No. Valves	MNI	Percentage of MNI Total
Quadrula asperata (Lea) warty back white mussel	489	249	20.3
Quadrula metanevra (Lea) monkey face	27	15	1.2
Quadrula aspera (Lea) maple leaf	2	1	0.1
Quadrula spp.	10	6	0.5
Fusconaia ebena (Lea) ebony mussel	403	210	17.1
Fucsonaia rubida (Lea) pigtoe	27	17	1.4
Fusconaia cerina (Conrad)	1	1	0.1
Pleurobema decisum (Lea)	105	55	4.5
Pleurobema cordatum (Rafinesque)	89	46	3.7
Pleurobema spp.	161	90	7.2
Obovaria subrotunda (Rafinesque)	52	28	2.3
Obovaria unicolor (Lea) hickory nut mussel	74	40	3.3
Obovaria spp.	6	-	-
Obliquaria reflexa (Rafinesque) three-horned warty back	46	26	2.1
Amblema plicata perplicata (Conrad) three-ridge	40	22	1.8

TABLE 5 (continued)

Species	Total No. Valves	MNI	Percentage of MNI Total
Lampsilis excavata (Lea) pocketbook	40	21	1.7
Lampsilis straminea (Lea)	13	9	0.7
Lampsilis spp.	4	-	-
Plagiola lineolata (Rafinesque) butterfly	32	16	1.3
Elliptio crassidens (Lamarck) elephant's ear	22	15	1.2
Elliptio dilatatus (Rafinesque) spike, lady-finger mussel	5	4	0.3
Elliptio spp.	5	-	-
Tritogonia verrucosa (Rafinesque) Pistol-grip	12	6	0.5
Epioblasma penita (Conrad)	9	6	0.5
Potamilus purpuratus (Lamarck) pink heel-splitter	6	4	0.3
Ligumia recta (Lamarck) black sand shell	3	2	0.2
Villosa lienosa (Conrad)	2	2	0.2
Plectomerus dombeyana Val. bank climber	1	1	0.1
Unidentified valves	769	334	27.2
TOTAL	2455	1226	99.8

Some of the large river mussel species are represented by low percentages in the sample. These mussels commonly lived in the harder-to-exploit niches in the river and consequently were collected only occasionally. For example, Plagiola lineolata, Quadrula metanevra and Amblema plicata perplicata prefer deeper water, and Tritogonia verrucosa and Plectomerus dombeyana are usually buried in a mud substrate (ibid.). The relative percentages of the various mollusc species and the habitat preferences of these mussels suggests that the pelecypods exploited during the Late Woodland were collected in relation to their abundance and availability within the riverine environment. Moreover, those species that lived on shallow bars were taken in favor of those in deeper water, or other less accessible riverine areas.

MISSISSIPPIAN FRESHWATER MUSSEL REFUSE

The samples of freshwater bivalves from Mississippian deposits were separated into those from pits on the one hand and those from test units excavated in the midden on the other. When possible the samples from the pit features were subdivided further into the four periods recognized for the Mississippian occupations of the Lubbub Creek Archaeological Locality. However, six features could not be assigned to a particular Summerville period and were tabulated separately. The molluscan remains from each of the Summerville periods, the midden sample, and the Mississippian features will be described separately with respect to the preservation of the shell, types of excavation units containing shell refuse, and characteristics of the mollusc debris peculiar to that period or sample. A summary of the Mississippian freshwater mussel procurement strategy will conclude the discussion.

Very little mollusc debris is associated with Summerville I feature fill. Ninety-eight percent by count of the total mussel shell refuse from pit features of this period was identified, and this figure is represented by the debris from just one pit (Table 3 and Table 4). This single feature, Pit 9, located in the northern section of hectare 500N/-400E, was associated with Structure 1. The pit was a large, oblong, moderately deep feature. The unit was not noted as being stratified, and the shell apparently was distributed evenly throughout the fill. The preservation of the shell from this pit feature was excellent.

In order to increase the sample of shell from the early part of the Mississippian occupation, one additional unit was added to the pit feature tabulations, and its shell count values were included in Table 6 for the Summerville I tabulations. This units, USN 3612, was a cut from the daub zone overlying Structure 1 in hectare 500N/-400E. The bivalve preservation in the structure was unfortunately extremely poor. Eighty-six percent of the valves from USN 3612 could not be identified because of the flaky, eroded condition of the shell. Including this unit only increased the count and weight of the sample; it did not add any more species to the list of 17 exploited molluscs that were identified from the Summerville I pit feature refuse.

The pit features from two of the Mississippian periods, Summerville II and Summerville III, were combined for the mollusc analysis, as they were combined for other analyses. Several features that had mollusc shell debris contained ceramics representative of both periods; other features had ceramics diagnostic of either the late Summerville II or the early Summerville III period. The fill of 15 of the Summerville II-III pit features contained some

TABLE 6

Freshwater Bivalves from Selected Mississippian Excavation Units

Species	Summerville I			Summerville II-III			Summerville IV		
	Total No. Valves	MNI	%MNI	Total No. Valves	MNI	%MNI	Total No. Valves	MNI	%MNI
[illegible]tema [illegible] (Lea)	1.3	83	27.1	320	168	9.9	688	354	30.3
[illegible]bema cordatum (Rafinesque)	5	4	138	110	60	3.5	54	28	2.4
[illegible]tema spp.	8	2	0.7	115	53	3.1	107	61	5.2
[illegible]ptio crassidens (Lamarck) [illegible] ear	82	47	15.4	181	101	5.9	230	133	11.4
[illegible]ptio dilatatus (Rafinesque) [illegible] lady finger mussel	7	6	1.7	11	7	0.4	57	41	3.5
[illegible]ptio cf. arctatus (Conrad)	0	-	-	0	-	-	1	1	0.1
[illegible]ptio spp.	0	-	-	34	19	1.1	0	-	-
Quadrula asperata (Lea) warty back white mussel	33	21	6.9	107	56	3.3	159	86	7.4
Quadrula metanevra (Lea) monkey face	5	3	1.0	47	24	1.4	30	19	1.6
Quadrula aspera (Lea) maple leaf	0	-	-	2	1	0.1	3	3	0.3
Quadrula spp.	0	-	-	4	3	0.2	3	-	-
Fusconaia rubida (Lea) pig-toe	9	6	1.7	47	24	1.4	55	30	2.6
Fusconaia ebena (Lea) ebony mussel	5	3	1.0	33	17	1.0	42	22	1.9
Amblema plicata perplicata (Conrad) three-ridge	5	4	1.3	34	17	1.0	45	24	2.1
Obovaria subrotunda (Rafinesque)	2	1	0.3	21	14	0.8	14	10	0.9
Obovaria unicolor (Lea) hickory nut mussel	5	3	1.0	22	15	0.9	31	18	1.5

TABLE 6 (Continued)

Species	Summerville I			Summerville II-III			Summerville IV		
	Total No. Valves	MNI	%MNI	Total No. Valves	MNI	%MNI	Total No. Valves	MNI	%MNI
Obovaria spp	5	3	1.0	30	12	0.7	36	25	2.1
Megalonaias gigantea (Barnes) washboard	0	-	-	1	1	0.1	0	-	-
Lampsilis excavata (Lea) pocketbook	5	3	1.0	3	3	0.2	4	2	0.2
Lampsilis straminea (Lea)	2	1	0.3	2	2	0.1	8	4	0.3
Obliquaria reflexa (Rafinesque) three horned warty back	0	-	-	13	11	0.6	18	10	0.9
Plagiola lineolata (Rafinesque) butterfly	1	1	0.3	7	4	0.2	17	9	0.8
Ligumia recta (Lamarck) black sand shell	1	1	0.3	0	-	-	0	-	-
Tritogonia verrucosa (Rafinesque) pistol grip	1	1	0.3	1	1	0.1	8	5	0.4
Epioblasma penita (Conrad)	3	2	0.7	6	6	0.4	11	8	0.7
Villosa sp	0	-	-	1	1	0.1	0	-	
Unidentified valves	289	111	36.3	2242	1080	63.5	734	274	23.5
TOTAL	611	306	99.6	3400	1700	100.0	2355	116[illegible]	10[illegible]

molluscan remains. About one-half of these features (N=7) contained only small quantities of shell debris. From the eight other features, all of which contained a large number of bivalves, seven were c[illegible] identification.

One of the selected features, Pit 152, was associated with Structure 7 [illegible] the northwestern corner of hectare 400N/-300E. Pit 0, located in the south central part of the same hectare, was a large, shallow, amorphous feature. This unit lay beneath a plow zone which had a high density of inclusive shell (Figure 1). Three of the four sections in which this pit was excavated were sampled. The shell was only in fair condition; approximately 60 percent of the valves were identifiable.

Another feature, Pit 4, was excavated in the north central part of hectare 500N/-400E. This huge, oblong, shallow pit contained more shell than any other of the Summerville II-III pit features, but it also was the one with the poorest preservation. Eighty-five percent of the valves from this feature were unidentifiable. In the northeastern corner of the same hectare was feature 31. This was a large, oval, moderately deep pit. Ninety-two percent of the bivalves in this sample could not be identified.

All of the other features from which samples were identified were excavated in hectare 400N/-400E. Pit 28 was an oval-shaped, shallow feature associated with the structure and midden complex in the northeastern portion of the hectare. Pit features 1 and 7 were excavated in the center part of the hectare. Over one-half of the shell valves in Pit 1 and one-third of the valves in Pit 7 could not be identified. The other pit in this hectare contained shell remains in better condition. As a whole, this period had the greatest percentage of unidentifiable valves; just 36.5 percent of all the valves were identifiable. Twenty species were identified in the sample total.

Ten features associated with the Summerville IV occupation contained mollusc shell refuse, and a bivalve sample from only one of them [illegible]s identified. This one feature, however, accounted for 87 percent of the mollusc debris found in pit features from the Protohistoric period. This pit was located in hectare 500N/-400E. Pit 14 was a huge, amorphous, shallow pit located just north of Structure 1. This feature contained more than 4500 valves, and the preservation of the shell was excellent. Nineteen naiad species were identified in the sample from this pit.

Two additional excavation units, a shell concentration and a structure level, were included in the Summerville IV tabulations (Table 6). The first unit was located in hectare 500N/-400E. Half of the mollusc shells could be identified in this sample. The structure unit was cut from the second level of Structure [illegible] situated in hectare 400N/-300E. The preservation of the bivalves in this sample was excellent; 88 percent of the shell was identifiable.

The remaining 99 pit features from the site that contained some molluscan remains were designated as Mississippian features. Of these features only seven (7 percent) contained a shell count greater than 100 valves in their f[illegible]. Six of the seven pits were [illegible]n for the analysis, which represents 3[illegible] percent by count of the shell remains found in the Mississippian pit features. Nineteen different species were identified from the shell refuse remains in these Mississippian features.

shell debris. For the site as a whole, however, there is no significant correlation between either mollusc debris and fire-cracked chert or mollusc debris and cracked cobble fragments. This certainly does not preclude the possibility that mussels could have been steamed open by the inhabitants at the Lubbub Creek Site, but it does suggest that such was not the case.

Freshwater mussels would not have been a major food component in the prehistoric diet. The shellfish were a supplementary food, which added necessary nutrients and were probably also an emergency food (Morse 1964). Results of a quantitative analysis on the soft parts of freshwater mussels have been published by Parmalee and Klippel (1974:431-432). These findings indicate that although shellfish provide higher amounts of iron, calcium, and phosphorus than do similar quantities of other animal meat, they contain far fewer calories per 100.0 g of meat than do such animals as deer, rabbit, turkey, and catfish. The protein content of the mollusc's meat is between eight percent and nine percent. The authors state that it would have taken enormous quantities of freshwater mussels (228,000 to 270,000 individuals) to sustain a band-sized population for one month (ibid.:433). Mussel collection might have become more important and have increased during periods in which other foodstuffs failed. This emergency use of naiads is implied in a letter written by the Spanish explorer Marcos Delgado (translation: Boyd 1937:19). The conquistador explains that he was informed by the Mobile chiefs that the drought of that year (1661) had been so severe that the Indians had not been able to harvest their corn, and had had to subsist on shellfish.

In conclusion, the pattern of freshwater mussel exploitation did not change markedly during the Late Woodland and Mississippian occupations in the Lubbub Creek Archaeological Locality. From the Middle Miller III (800 A.D.) throughout the protohistoric occupation (1500 A.D.), shellfish were probably gathered during the summer to early fall months by wading out to gravel bars in the Tombigbee River. Occasionally mussels might have been collected from small creeks in the area. Apparently the smaller sized species and the younger specimens of the larger species were preferred. The various species were collected in relation to their abundance and availability in the river. The shellfish meat was utilized as supplementary food which provided calcium, phosphorus, and iron, essential elements lacking in other types of animal meat.

SHELL ARTIFACTS

The primary reason for exploiting freshwater mussels was to utilize the animal's soft parts for food. After the meat had been extracted, the valves were usually discarded without any other modifications except for an occasional scorching. Some species of mollusc, however, may have been selected intentionally for specific purposes, and indications of either use wear or manufacturing processes must not be discernible on the valves. For example, the inclusion of relatively uncommon species (uncommon in the sense that their occurrence in the refuse is rare) in postmold fill suggest that certain naiads may have served a special function. The mussel shell contents of one postmold were analyzed. This postmold, PM 76, located at [illegible].75N [illegible], was not the part of any recognizable pattern (i.e., structure). A total of [illegible]3 valves weighing [illegible]39.1 g were contained within the [illegible]. Nine pairs of valves (six Elliptio crassidens and three Amblema plicata perplicata) weighed [illegible].2 g, were in very good condition, and were

Fig. [illegible]. The location of recent mussel beds in the Tombigbee River. (Adapted from Caddell 197[illegible]:11.)

TABLE 8 (Continued)

Species	Lubbub Creek Site	Epes, Sumter County, 1939	River Mile 33[illegible] - 3[illegible]2.5, 1974
Obovaria subrotunda	X	-	
Plagiola lineolata	X	X	X
Leptodea fragilis	-	X	X
Leptodea alabamensis	-	X	
Potamilus purpuratus	X	X[2]	X
Medionidus mcglameriae	-	X	-
Ligumia recta	X	X	**
Villosa lienosa	X	X[3]	**
Villosa concestator	-	X[4]	
Lampsilis anodontoides	-	X	X
Lampsilis excavata	X	X	X
Lampsilis straminea	X	*	X[6]
Epioblasma metastriata	-	X[5]	-
Epioblasma penita	X	-	X
Truncilla donaeiformis	-	X	X
Plectomerus dombeyana	X	X[7]	X
Arcidens confragosus	-	*	X
Lasmigona complanata	-	*	X

X = species present

\- = species not present

* = species was not collected at this location but was collected from Tombigbee River in either 1906 by Hinkley or in the 1930's by van der Schalie.

** = species was not collected at either of the two river miles noted above in the table but was collected at other Tombigbee River Mile locations by Yokley and Gooch in 1974.

[1]Recorded as *Quadrula pustulosa* by van der Schalie (1939)

[2]Recorded as *Proptera purpuratus* by van der Schalie (1939)

[3]Recorded as *Micromya lienosa* by van der Schalie (1939)

[4]Recorded as *Micromya concestator* by van der Schalie (1939)

[5]Recorded as *Dysnomia metastriata* by van der Schalie (1939)

[6]Recorded as *Lampsilis radiata claibornensis* by Yokley (1975)

[7]Recorded as *Plectomerus trapezoides* by van der Schalie (1939)

TABLE 8 Synoptic Table of Freshwater Mussel Species Collected from the Tombigbee River

Species	Lubbub Creek Site	Epes, Sumter County, 1939	River Mile 330.5 302.5, 1974
Fusconaia ebena	X	X	X
Fusconaia rubida	X	X	X
Fusconaia cerina	X	*	-
Megalonaias gigantea	X	X	**
Amblema plicata perplicata	X	X	X
Quadrula asperata	X	X'	X
Quadrula aspera	X	X	X
Quadrula forsheyi	-	X	-
Quadrula rumphiana	-	X	X
Quadrula metanevra	X	X	X
Quadrula stapes	-	X	X
Tritogonia verrucosa	X	X	X
Pleurobema cordatum	X	X	-
Pleurobema marshalli	-	X	X
Pleurobema tombigbeanum	-	X	-
Pleurobema decisum	X	*	X
Pleurobema bulbosum	-	*	X
Pleurobema nux	-	*	X
Pleurobema taitianum	-	*	X
Elliptio crassidens	X	X	X
Elliptio dilatatus	X	X	**
Elliptio arctatus	X	X	**
Strophitus tombigbeensis	-	X	**
Obliquaria reflexa	X	X	X
Obovaria unicolor	X	X	X
Obovaria castanea	-	X	-

might not have been collected because, to a certain extent, the native Americans were selective in their choice of mollusc species; they took the smaller sized specimens and those species available in easily accessible locations. In addition, it is likely that information on the procurement of some species has been lost due to the poor preservation of the valves. The mollusc fauna available for exploitation most likely would have been diverse and abundant.

The locations of contemporary mussel beds in the Tombigbee River are shown in Figure 3. Jenkins, Curren and DeLeon located these mussel beds with the assistance of local commercial fishermen and by personal observation (Jenkins, et al. 1975:42). Mussel beds were not depicted in the bend of the river that flanks the site locality because this particular riverine area has several meander scars, and the exact location of the river channel during the occupancy of the site by prehistoric populations is unknown (Cole: Chapter 2, Volume 1). The river channel shown in Figure 3 was the active river channel in the mid-nineteenth century (Caddell 1979). Mussel beds were probably located near the site. A high correlation between large prehistoric sites and recent mussel beds has been documented for the central Tombigbee River area (Jenkins, et al. 1975:42).

The most likely time of year for the collection of freshwater mussels was during the summer and early fall months. After the high water levels from the spring floods had subsided, the lower summertime river level would have maximized the exposure of the gravel bars, and the warmer summer temperatures would have facilitated gathering the shellfish (Styles 1978:142). Mussels could have been procured either by wading or possibly by diving in deeper water (ibid.). Many ethnographic accounts have pointed to the summer months as the time for gathering and preserving shellfish. Swanton (1946:259) indicates: "Summer was first and foremost the time for raising corn and other vegetables, and [it was] the great fishing season . . . surplus fish and shellfish were dried over hurdles for later consumption."

The mussels probably were cooked in a variety of ways, but steaming and boiling seem to have been the common methods. Lawson (1860:266) noted that mussels were eaten by the Carolina Indians after the shellfish had been boiled for five to six hours. Another nineteenth century account (in Swanton 1946:372) describes how the Virginian Indians boiled oysters and mussels together to make a thickened meat broth. Archaeologists, however, have tended to stress the steaming process. Morrison (1942:381) contended that the mussels found in midden refuse from sites located along the Tennessee River were steamed open. He argued that the quantities of water-cracked rock fragments found together with the shell in the deposits proved that the rocks were gathered by the Indians and heated in a fire after which the mussels were placed upon the rocks and cooked. He further added that the rocks must have "been used over and over again, as the pieces remaining are small, have been split apart many times by the action of the water and juices coming from the mussels." In Woodland Period sites in central Illinois Baker (1941:54) noted: "Freshwater shells occurred at a depth of about four feet in several places and in distinct deposits. Some shells had been opened but others were nested together and charcoal and ash were found with them."

In the Lubbub Creek Late Woodland samples a large amount of unmodified lithic debris was noted in those features which contained large quantities of

host fish (Yokley 1975:93).

Mussel beds within the same river area are not necessarily composed of the same species of molluscs, and they do not have to contain equal numbers of each species (Parmalee 1967:13; Yokley, personal communication). Van der Schalie (1939:3) mentioned that mussels studies conducted in several rivers demonstrated that species found in one location of the drainage are often absent in another. The presence and abundance of mussel specimens in a given river location is primarily the result of the movements and habits of the host fish. An individual mussel will rarely move more than a few feet during a lifetime (Matteson 1960:118). The differences, then, in the exploitation of mussels during the Late Woodland and Mississippian periods are most likely reflections of the exploitation of different concentrations of molluscs in the Tombigbee River. If earlier beds were depleted, as can happen, later populations would have had to gather mussels from another location. It may have been that the species of mussels exploited during the Woodland Period were more attractive to the inhabitants of the site for reasons such as taste or perhaps their beds were those closest to the site. If these more desirable mussel beds were depleted, then with some minor readjustments in the procurement strategy, the Mississippians exploited naiad beds that might have been either further from the site or contained less preferred species. However, what is important is that the mussels represented in the samples from both periods are indicative of the same general exploitation pattern: collecting the greatest numbers of shellfish, probably from gravel and sand bars, with the least amount of effort.

Although the size of mussels collected through all the different phases varied from very small juvenile forms to large adult valves, the preference seems to have been for the smaller sized species and the young forms of the larger mussels. A similar age and size distribution has been found to be true of some Illinois archaeological refuse (Parmalee et al 1972; Parmalee 1969). According to Yokley (1975:70), "As a mussel gets older, the foot enlarges and becomes more fibrous and tougher." He also mentions that the adult forms of Megalonaias gigantea, Amblema plicata perplicata and Plectomerus dombeyana, all of which are rare or absent in the Lubbub samples, become quite large as they grow older. In addition to the possibility that they were ignored because of the texture of their meat, these adult specimens also occupy harder to exploit niches in the river: in deeper pools or deeply buried in the substrate.

The prehistoric Native Americans seemed to have gathered a wide variety of the available riverine mollusc species. Exactly how many different species existed in the Tombigbee River and nearby creeks during the periods in which the site was occupied is difficult to estimate. However, by using reports which list mollusc species collected from the Tombigbee River in the 1930's (van der Schalie 1939, and in 1974; Yokley 1975), an approximation of the mollusc diversity is possible. A total of 44 different species have been collected in the lower central stretch of the Tombigbee River (Table 8). All of the mussels (except Obovaria subrotunda) found in the Lubbub Creek Site refuse were also recorded as being present in the river during the twentieth century. Obovaria subrotunda was recorded as present in the Cahaba River in the 1930s by van der Schalie (1938). Species listed in Table 8 but which were not among those shellfish species identified in the archaeological debris could easily have been part of the prehistoric riverine fauna. Some species

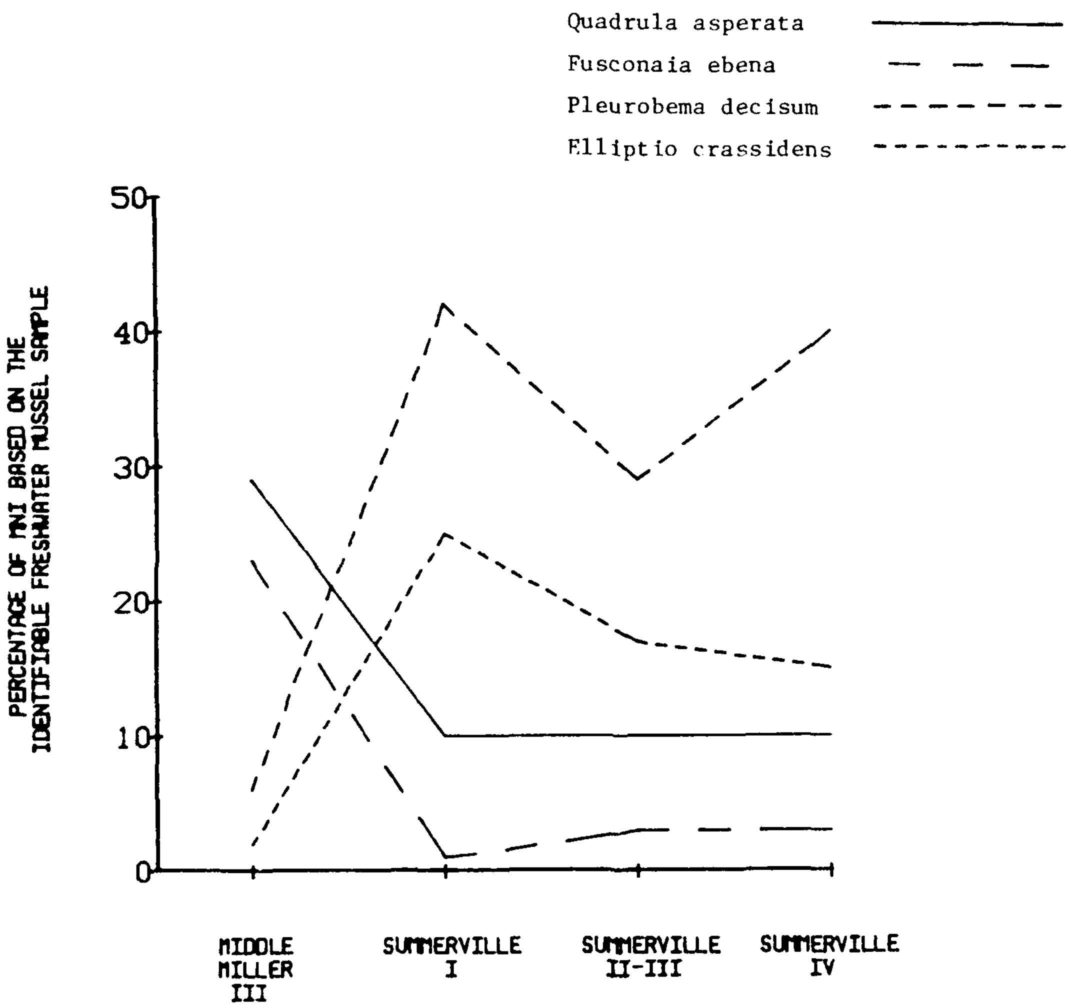

Fig. 2. Changes in the percentages of certain freshwater mussels collected during the Woodland and Mississippian Periods.

The inclusions or exclusions of any one of the four mussels does not alter the conclusions about the mollusc collecting localities. What does change significantly when the earlier and later periods are compared are the percentages of MNI of certain species.

The two most frequent mussel species gathered during the Late Woodland phase were Quadrula asperata and Fusconaia ebena. The abundance of these species in archaeological features decreased dramatically at the beginning of the Mississippian period (Figure 2), and two other species, Pleurobema decisum and Elliptio crassidens, became the most numerous mussels in the samples. This change in the most frequently collected species is not believed to be the result of either sampling or preservation error.

An important phenomenon among the individual samples is that all the excavation units of a given phase seem to resemble one another in their mollusc refuse contents. The relative proportions of the various naiad species are similar for the pit features, structure units, and midden samples for each occupation. For example, in every one of the Late Woodland samples the two most common species were Quadrula asperata and Fusconaia ebena; in the Mississippian samples Pleurobema decisum and Elliptio crassidens are always the most common specimens. The Late Woodland material was better preserved overall than the Mississippian remains, but since both periods had several well-preserved units, and accepting this idea that an excavation unit is representative of the period as a whole, then poor preservation cannot be an explanation for the decreases and increases in the most commonly collected mussels. Because different shell species were not found either in different areas of the site or in different types of excavation units, sampling error is not considered to be a factor.

Before an explanation is proposed for the observed increases and decreases in the frequencies of the four mussel species depicted in Figure 2, a brief discussion of mussel beds is necessary. Mussel beds can be described simply as areas in the river where large numbers of shellfish are located. These mollusc beds are stable, predictable sources of food until such a time when the bed has been depleted (Styles 1978:142). The numbers of the various mussel species present in a given bed depends in part on the river conditions (bottom composition, current, depth of water, etc.) and also, to an even greater extent, upon the species of fish which inhabit that part of the river or stream.

Yokley (1975:71) states: "A prerequisite to good mussel beds are good feeding and spawning sites for the host fish species . . . shallow gravel and sandy riffle areas attract fish, mussels and a variety of insect larvae." This fish to mussel relationship is necessary for the survival of the mollusc. An extremely important period in the development of a young mussel is the glochidium stage. After the fertilized mussel eggs have developed into glochidia (immature larvae which possess only the embryonic stages of a mouth, intestines, heart and foot), the female mollusc expels the glochidia into the water. For further development the larvae must be taken up by host fish for one to six weeks, during which time the parasitic larvae develop adult organs and features. When the mollusc has matured, it drops to the bottom and begins an independent existence (Parmalee 1967:8-9). Some mussels require a specific fish species to serve as the host, but others can attach themselves to several different species, and at least one mussel, Obliquaria reflexa, requires no

available (ibid.). These 15 species seem to have mean lengths and heights (the only two measurements that could be taken on some of the valves) that are about one half the mean values recorded for the live-collected mussels (ibid.). If the mean weights from the latter groups are halved, then the mean mussel weight per species represented by the Lubbub mollusc debris varies from 4 g up to 40 g per individual mollusc. The two most common species gathered during the Late Woodland period provided roughly nine grams per individual (Quadrula asperata) and 14 grams per individual (Fusconaia ebena). In the Mississippian period the second most common species, Elliptio crassidens, contributed 24 grams per individual; unfortunately there is no information on the most common species, Pleurobema decisum.

It may be significant that the Mississippians frequently gathered Elliptio crassidens, which has a much higher meat weight than either of the two most commonly procured Late Woodland naiad specimens. However, the comparison of mollusc meat weights is impossible because of the lack of information on Pleurobema decisum, the most common species found in the Mississippian mollusc sample. Today Pleurobema decisum is a rare species in the Tombigbee River (Yokley 1975:95), and little published information is available on its habitat requirements and morphological characteristics. The archaeological specimens from Mississippian pit feature samples indicate that those specimens of Pleurobema decisum, which the Lubbub inhabitants gathered, represent a small-sized mollusc. The mean height of the specimens (N=119) is 23.95 mm; the height ranges from 16.0 mm to 31.8 mm. The mean length (N=10) is 39.78 mm; the length ranges from 35.0 mm to 43.4 mm. Although Elliptio crassidens provided more meat per individual mollusc than either of the two most common Late Woodland specimens, it is possible that Pleurobema decisum contributed less meat per individual mollusc than either of the Late Woodland species.

In addition to not having comparable information for all of the identified species, another difficulty in estimating the weight of mussel meat is the problem with the unidentified valves. As previously stated, the species which constitute the unidentifiable group can not be determined with any certainty. Clearly, when there is such a large difference in the average weight of meat per mussel species, and there are many different mussel species in the unidentifiable sample, then the calculations of the total freshwater mussel meat portion of the diet become almost meaningless. Except for perhaps a very general comparison with other animal meat contributions, estimations of the meat weights provided by mussel species cannot be used to compare mollusc meat utilized either per person, per year, or per archaeological occupation. Such calculations would be little better than guesses.

About one-quarter (27.2 percent) of the shellfish valves from the Late Woodland features could not be identified, and slightly more than one-half (56.9 percent) of the mussels from Mississippian samples could not be identified. Comparing the lists of identified specimens from both archaeological periods, the number of different species collected is equal (N=23). The lists have 21 species in common, and each list has two species not included in the other. Fusconaia cerina and Plectomerus dombeyana are each represented in the Late Woodland list by one valve but are absent in the Mississippian mollusc fauna. Megalonaia gigantea and Elliptio cf. arctatus, the former represented by three valves, the latter by one, are on the Mississippian species list but are not found in the Late Woodland features.

from the two types of excavation units would probably not have differed much if the preservation of the mussels had been the same. However, if the mussel shell from the midden units alone had been analyzed, a bias would have resulted which favored the thicker-shelled species, which in turn would have influenced the interpretations concerning the riverine areas where the mussels were collected.

The thicker-shelled species with large pseudocardinal teeth, deep adductor muscle scars, and well-developed lateral teeth form these features as an adaptation to a gravel bar habitat. The more massive features enable the naiads to maintain their position in a swift current as it moves over a hard bottom. Small stream forms and backwater species, especially those species which prefer a mud bottom and quiet waters, will generally have thinner shells and internal features which are not nearly as massive as the large river naiads. These thin-shelled mussel species were not found in any of the midden samples, and unless some of the pit features which contained well-preserved shell had been analyzed, the small stream habitat might have been completely overlooked.

It seems logical, then, to compare species of molluscs which were represented in the features. It should be noted, however, that some of the features from which shellfish were identified contained a high percentage of unidentified bivalves. The most plausible explanation for the poor preservation of shell in a feature, or in any excavation unit, is that the density of shell per unit of excavated fill is low. This conclusion is supported by the relationship between shell density and good shell preservation apparent in the Lubbub Creek samples. All the pit features that contained shell strata zones had good to excellent preservation of the bivalves remains (less than one quarter of the valves were unidentifiable). In feature 14 (500N/-400E), which had a huge number of bivalves in its fill, the preservation of shell was also excellent (less than one quarter of the valves were unidentifiable). In the midden samples where the density of shell was low (examples: USN 2321, 147 shells per m^3; USN 4588, 15 shells per m^3), the preservation was very poor. Where the mussel refuse was found in a shell concentration, the density of shell was significantly higher (USN 4316, 14,325 shells per m^3) and the preservation much better. Choosing excavation units that have a high density of shell remains for a molluscan refuse analysis should provide the maximum amount of information for the analyst.

If the preservation of the mussels identified from the Lubbub Creek Site had been better (complete valves, not just small identifiable beak portions), then measurements of the valves (length, width, height, and weight) could have been used to estimate the total weight of molluscan meat represented by the naiad valve remains. However, the majority of the valves were too fragmentary to provide accurate estimations of the original shell size. Parmalee and Klippel (1974:431), who devised the shell size-meat weight correlation formula, advised that when the archaeological shell samples were too fragmentary for measurements, the mean weights derived from recent molluscs could be used to estimate the prehistoric mollusc meat weights. They stressed that the relative size of the archaeological specimens should approximate the mean size of the species presented in their table (Parmalee and Klippel 1974:424).

Information for only 15 of the 25 species in the Lubbub sample is

they did for the Late Woodland populations. Pleurobema decisum and Elliptio crassidens represented 53 percent of the identified mollusc from the Mississippian components. Both of these naiads have been collected recently on or near gravel bars in the Tombigbee River (Yokley 1975); but beyond these observations information regarding their specific environmental preferences is not available. Mussels which are more difficult to exploit, such as those species located in deep water or bivalves buried deeply in the substrate, had only minimal representation in the sample. Like the earlier Late Woodland molluscan remains, the Mississippian population appears to have gathered mussels in relation to their abundance and accessibility.

A COMPARISON OF LATE WOODLAND AND MISSISSIPPIAN FRESHWATER MOLLUSC EXPLOITATION

Prior to statements about the similarities and differences in Late Woodland and Mississippian mollusc exploitation, factors which influenced these conclusions must be discussed. Attempts to quantify the molluscan refuse for meaningful comparative purposes met with severe limitations. The major factor which affected the comparison of the species and abundance of their mussel shell debris from each archaeological phase was preservation. Although biases in the sample data produced by preservation cannot always be compensated for, the recognition of potential discrepancies in the data will undoubtedly lead to more accurate accounts of subsistence activities.

The preservation of mussel shell over the site varied significantly. In the sample of units chosen for analysis, the percentage of unidentified valves per unit ranged from a low of 4.8 percent (Pit 10, USN 1683) to a high of 94.4 percent (midden unit, USN 6657). The preservation of shellfish from midden units was consistently worse than shell from pit features. A high percentage of unidentifiable valves can bias not only the relative numbers of mollusc species reported from the site, but also the location from which the mussels were gathered.

For example, comparing the Mississippian midden and pit feature samples (Table 7) will demonstrate the biases resulting from poor preservation. The mussel shell samples from the various midden areas did not differ. The shells from all the samples were chalky, flaky, and extremely fragmentary. A high percentage of the mussels could not be identified (over 78 percent), and the mussels which were identified were characteristically thicker-shelled varieties. Each sample contained the same relative quantities of different species; the common forms were Elliptio crassidens, Fusconaia ebena, Quadrula asperata, Obliquaria reflexa and Pleurobema decisum.

When these midden samples are compared to the feature units, several differences are apparent. The mussel valves from some of the features are hard, complete shells which exhibit all the features of a recently collected mussel specimen. With shell in such good condition it becomes possible to identify more species. The number of species identified from this sample of Mississippian features is 19 and the number of mussels identified from the midden units is 13. About one-third of the variety of freshwater molluscs would have been lost if the feature units had not been analyzed.

The midden samples do not contain any species not found also in the Mississippian feature samples. The information regarding mollusc exploitation

TABLE 7 (Continued)

Species	Mississippian Midden Units			Mississippian Pit Features		
	Total No. Valves	MNI	Percentage of MNI	Total No. Valves	MNI	Percentage of MNI
Obliquaria reflexa (Rafinesque) three-horn warty back	12	7	0.5	0	-	-
Epioblasma triquetra (Conrad)	0	-	-	1	1	0.2
Obovaria unicolor (Lea) hickory nut mussel	2	1	0.1	9	7	1.4
Obovaria subrotunda (Rafinesque)	0	-	-	1	1	0.2
Obovaria spp.	4	3	0.2	5	2	0.4
Amblema plicata perplicata (Conrad) three-ridge	9	5	0.4	7	6	1.2
Plagiola lineolata (Rafinesque) butterfly	3	3	0.2	2	2	0.4
Lampsilis straminea (Lea)	0	-	-	1	1	0.2
Lampsilis excavata (Lea) pocketbook	1	1	0.1	3	2	0.4
Tritogonia verrucosa (Rafinesque) pistol-grip	0	-	-	1	1	0.2
Potamilus purpuratus (Lamarck) pink-heel splitter	0	-	-	3	2	0.4
Megalonais gigantea (Barnes) washboard	0	-	-	2	1	0.2
Unidentified valves	2398	1179	85.1	331	139	28.6
TOTAL	2772	1386	100.1	976	486	100.0

TABLE 7

Freshwater Bivalves from Selected
Mississippian Excavation Units
Excavated at the Lubbub Creek Archaeological Locality

Species	Mississippian Midden Units			Mississippian Pit Features		
	Total No Valves	MNI	Percentage of MNI	Total No Valves	MNI	Percentage of MNI
Pleurobema [illegible] (Lea)	96	52	3.8	171	87	[illegible]
Pleurobema cordatum (Rafinesque)	16	9	0.6	28	17	[illegible]
Pleurobema spp	54	28	2.0	17	11	[illegible]
Elliptio crassidens (Lamarck) elephant's ear	71	40	2.9	261	131	[illegible]
Elliptio dilatatus (Rafinesque) spike, lady-finger mussel	10	5	0.4	54	32	6.6
Elliptio spp.	0	-	-	1		
Quadrula asperata (Lea) warty back white mussel	52	26	1.9	54	28	5.8
Quadrula metanevra (Lea) monkey face	11	6	0.4	1	1	0.2
Quadrula aspera (Lea) maple leaf	0	-	-	1	1	[illegible]
Fusconaia ebena (Lea) ebony mussel	26	17	1.2	8	1	[illegible]
Fusconaia rubida (Lea) pig-toe	7	4	0.3	14	9	[illegible]

Two of the analyzed Mississippian features were in hectare 400N/-500E. Feature 8, a large, oval, shallow refuse pit, was located in the southern section of the hectare. The plowzone above this feature was within the area described as the high shell count region (Figure 1). Feature 140, an oval, shallow pit, was situated in the northwestern corner of the hectare. The preservation of shell in both pits was excellent.

The remaining four Mississippian pits were all excavated in hectare 400N/-400E. Three of these features were shallow refuse pits located in the strip of 10 by 10 meter squares excavated in the central portion of the hectare. Feature 4 was an irregularly shaped pit in which two distinct zones were discernible. The molluscs remains were identified from the second level of the feature. Pit 10 was situated just outside of a structure complex. This large, oval feature was stratified, and level B, the second of the two levels, was described as a dense shell stratum. The third pit in this part of the hectare, Feature 16, was a medium-sized, oval refuse pit that contained dense quantities of ceramics, bone, and shell. The fourth pit from this hectare, Feature 53, was located outside of the structure-midden complex in the northeastern corner of the hectare. Except for Feature 16, the preservation of shell in these features was excellent.

In selecting midden samples from each hectare the most important criterion was that the unit have a molluscan weight of over 500.0 g. Six hectares (300N/-200E, 300N/-300E, 400N/-300E, 400N/-500E, 500N/-200E and 600N/-400E) did not have a unit that satisfied this condition. Midden areas in the four remaining hectares (400N/-400E, 500N/-300E, 500N/-400E and 600N/-300E) and a shell midden area in hectare 400N/-200E contained sufficient amounts of shell debris so that samples could be identified. Over 70 percent of the valves in these midden samples could not be identified. The preservation of shell was extremely poor, and just about the only information gained from these units was that the shells were from thick-shelled species. Only 13 species of naiads were identified in the midden sample.

The same mussel species and equal percentages of these species were found in all of the Mississippian samples whether that sample came from a pit feature, structure, or midden area. The midden samples did not increase the number of identified mussels exploited during the Mississippian Period. The most common species that were identified from the Mississippian features were also the most common species identified from the midden samples. A greater variety of species was found in the pit feature samples, and this diversity can be attributed to the better shell preservation in those units.

The Mississippians, like the Late Woodland populations, exploited two riverine areas: the creek and the major river channel. The species identified from the Mississippian units that preferred a creek habitat include _Obovaria unicolor_, _Tritogonia verrucosa_, _Lampsilis excavata_, _Lampsilis straminea_, _Fusconaia rubida_, _Elliptio dilatatus_ and _Elliptio_ cf. _arctatus_. The latter two species are primarily restricted to a creek environment, but the first five species can also be found in a large river. All of these species together account for 9.9 percent of the total identified mussels from the Mississippian sample.

Molluscs which lived on the sand and gravel bars in the river comprised the majority of the naiads collected by the Mississippian populations, just as

[illegible] be [illegible] unbroken [illegible] near the maximum length [illegible] attainable for their respective species, which [illegible] generally selected for by the inhabitants. A possible explanation [illegible] of these shells within the post [illegible] is that the mussels were selected because of their large size and were used to wedge the post against the ground. Although this is a very speculative statement regarding the use of [illegible], other shell specimens have been found on the site which can be interpreted as either utilitarian or ornamental artifacts.

Shell artifacts are those mollusc shells that have been modified by man either through use or by an intentional manufacturing process. Sixty-eight shell specimens have been identified as artifacts (Table 9). Functional labels have been assigned to the artifacts based primarily upon the interpretations of archaeologists who have described similar artifacts. Many ethnographic accounts describing the utilization of shells by Native North Americans are also supportive of some of these functional labels. However, this labelling of artifacts can be misleading and even detrimental to attempts to interpret artifact usage. Functional names have been included mainly to facilitate comparisons of the Lubbub Creek artifacts with the available archaeological literature. Because of the inherent implications that functional labels carry, the Lubbub Creek artifacts were divided into four broadly defined groups instead of being described as examples of particular functional types. In some instances these groups corresponded to functional categories previously established for shell artifacts by archaeologists (Winters 1969; Parmalee, et al. 1972).

Group I is composed of all those mollusc valves that had been modified by use. Eight of the artif[illegible]ts (12 percent) can be placed in this group, and all of them were freshwater bivalves which showed chipping along either the anterior, ventral, or posterior edges. Two distinct subgroups were represented by the use-worn artifacts. One subgroup contained three specimens: (1) a left valve of *Elliptio crassidens* that had been chipped unevenly along the anterior edge, the edge smoothed down, and had interior [illegible] scars; (2) a small right valve of *Megalonaias gigantea* that had been unevenly worn down along the anterior edge; and (3) an unidentified valve that had been chipped along one edge. These attributes have been noted on other archaeological specimens (Morse 1963:47), and are indicative of the functional type "scraper." Shell scrapers were used for many different purpose by the historic Indians. A bivalve shell was observed as a tool to remove corn kernels form a cob (Leechman 1949:56), and a shell scraper was sometimes used as a hide processing tool (Lawson 1860:56). Swanton (1946:253) mentions that bivalves were employed to hollow out canoes and to scrape bows into shape. It is likely that the edge-worn valves from the Lubbub Site also functioned as scrapers for many activities.

The other subgroup of artifacts modified by use included five examples of large massive bivalves that had uneven, worn-down edges. The valves were very flaky and chalky which made it impossible to tell whether or not the valves at one time had been polished from use. One specimen could be identified as a left valve of *Megalonaias gigantea*. A large hole had been made through the center of this artifact. Because of their size and thickness, the four unidentifiable specimens are also probably examples of this species. There are numerous, similar archaeological examples of perforated (and unperforated) valves of *Megalonaias gigantea* or other large

TABLE 9

A List [illegible] Modified Mollusc Shell Specimens Found During the 1978-1979 Excavations at the Lubbub Creek Archaeological Locality

USN	[illegible]	Excavation Unit	Archaeological Period	Species	Artifact	No. of Specimens
162[illegible]	3[illegible]N/-3[illegible]E	Pit 22	Middle Miller III	Goniobasis cf. pupaeformis	bead	5
2[illegible]	[illegible]N/-3[illegible]	Pit 32, Z-C	Middle Miller III	Specimens lost	bead	2
				(sm. gastropod cf freshwater)		
2[illegible]2	3[illegible]N/-3[illegible]	Pit 32, Z-D	Middle Miller III	Goniobasis cf pupaeformis	bead	[illegible]
2[illegible]5	4[illegible]N/-300E	Pit 28, Z-D	Middle Miller III	Elliptio crassidens	cut shell by-product	1
				cf. Lampsilis excavata	cut shell by-product	[illegible]
				indet. bivalve	cut shell by-product	5
2[illegible]36	[illegible]N/-3[illegible]E	Pit 8	Mississippian	Amblema plicata perplicata	cut shell by-product	1
				Elliptio crassidens	cut shell by-product	1
				cf. Ligumia recta	cut shell by-product	1
				indet. bivalve	cut shell by-product	9
3589	5[illegible]N/-400E	Extension	Mississippian	indet. bivalve	cut shell by-product	1
3619	500N/-[illegible]E	Pit 9	Summerville I	indet. bivalve	"scraper"	1
				Elliptio crassidens	cut shell	1
				Elliptio crassidens	cut shell by-product	3
				indet. bivalve	cut shell by-product	3
2309	4[illegible]N/-300E	Pit O, C-2	Summerville II-III	indet. bivalves	"hoe fragment"	1
2310	400N/-300E	Pit O, C-3	Summerville II-III	indet. bivalve	cut shell by-product	4
2[illegible]	400N/-300E	Pit O, C-4	Summerville II-III	indet. bivalve	cut shell by-product	1
4[illegible]23	500N/-400E	Pit 14, C-2	Summerville IV	Megalonaias gigantea	"scraper"	1
				Elliptio cf. dilatatus	cut shell by-product	1
				indet. bivalve	cut shell by-product	3
4[illegible]24	500N/-400E	Pit 14, C-3	Summerville IV	indet. bivalve	cut shell by-product	2
				cf. conch or whelk	bead fragment	1
2[illegible]21	400N/-400E	Extension 2, C-17	Mississippian	cf. conch or whelk	bead	1
				Elliptio crassidens	cut shell by-product	1
3051	300N/-300E	Postmold 78	Mississippian	indet. bivalve	"hoe fragment"	1
3459	400N/-300E	Structure 5, L-2, C-3	Mississippian	Elliptio crassidens	cut shell by-product	1
				indet. bivalve	cut shell by-product	1
4140	500N/-400E	Burial 2	Mississippian	indet. bivalve	"pendant"	1
4535	500N/-300E	Mound midden, Z-J	Mississippian	indet. bivalve	cut shell by-product	1
4732	500N/-300E	Postmold 16	Mississippian	indet. bivalve	"hoe fragment"	1

TABLE 9 (Continued)

USN	Hectare	Excavation Unit	Archaeological Period	Species	Artifact	No. of Specimens
5147	400N/-300E	Pit 89	Mississippian	indet. valve	cut shell	1
5665	500N/-300E	Postmold 180	Mississippian	cf. Megalonaias gigantea	"hoe"	1
7197	500N/-400E	Postmold 334	Mississippian	cf. Potamilus purpuratus	cut shell by-product	1
7200	500N/-300E	Postmold 337	Mississippian	Elliptio crassidens	cut shell by-product	1
7211	500N/-400E	Postmold 343	Mississippian	indet. bivalve	cut shell by-product	1
7222	500N/-400E	Postmold 553	Mississippian	indet. bivalve	cut shell by product	1
7228	500N/-400E	Postmold 356	Mississippian	indet. bivalve	"pendant"	1
8972	500N/-300E	midden	Mississippian	Elliptio crassidens	"scraper"	1
3755	500N/-200E	10 by 10 m	Mixed Woodland-Mississippian	indet. bivalve	"hoe fragment"	1
6602	600N/-300E	10 by 10 m	Mixed Woodland-Mississippian	indet. bivalve	cut shell	1
Total						68

thick-shelled species worked into tools (Morse 1963; Black 1967; Winters 1969; Parmalee, et al. 1972). All of these artifacts have been labelled as "shell hoes," and have been interpreted as being used either for agricultural cultivation (Black 1967:462; Parmalee et al. 1972:5) or for digging pits (Winters 1969:65). Those valves which have been perforated are thought to have been hafted (Black 1967:462). Winters (1969:65) proposed that such valves could also have been used to rake shells from a hearth area. Certainly any of these three activities, plus other digging or scraping tasks, are logical explanations for use of these large, massive valves.

None of the artifact specimens in Groups II, III and IV had been modified by use, but all of the artifacts were examples of at least one intentional manufacturing process (cutting, grinding, polishing or drilling). The artifacts in Group II and Group III were considered as examples of either finished artifacts or fragments thereof. Group II artifacts are not perforated; Group III artifacts are perforated. Group IV artifacts are fragments of cut shell that are considered to be the by-products of a manufacturing process and are not in themselves the desired end product.

Only three specimens, or four percent of all the shell artifacts, were included in Group II. All of these artifacts were fashioned from freshwater bivalves. On two of the specimens, USN 5147 and USN 6602, the pseudocardinal teeth and the lateral teeth had been ground down. Both of the artifacts had been cut: the former into an oval shape, the latter into possibly a square with rounded corners. Although USN 6602 appeared to have been perforated in the center, this notch had been made recently, probably during excavation. Neither of these two artifacts was well preserved. Both valves represent mussel species that have shallow beak cavities and compressed valves. The third specimen was a cut valve fragment of Elliptio crassidens. The lateral teeth had not been ground and the valve had been cut from a point just anterior to the lateral teeth across the shell to the ventral edge. A series of small triangular shapes had been cut into the exterior margins of the valve. The use of these three artifacts is uncertain, but they closely resemble the functional type "spoon." Shell spoons are typically described as bivalve specimens on which the pseudocardinal teeth and lateral teeth were ground down or cut away and then the edges smoothed. In some instances the shell margins were serrated (Parmalee et al. 1972:7). In Table 9, these artifacts are listed simply as cut shell.

The twelve artifacts, or 18 percent of all the shell artifacts, that constituted the third group, were divided into three categories: (1) ground valves of small freshwater gastropods, (2) cut, ground, polished, and drilled columella of large, marine gastropods, and (3) other perforated mollusc shell fragments. Eight freshwater univalves comprised the first category; six of these were identified as Goniobasis cf. pupaeformis and the other two specimens have been misplaced and their identification has not been determined. On the valve of each specimen a portion of the body whorl on the aperture side had been ground flat. The wear pattern indicated that the valves had been ground in one direction: parallel to the longitudinal axis of the valve. The grinding process formed an oval opening in the valve and exposed the snail's columella. A string could easily have passed through the ground opening, and the univalve bead could have been strung for personal embellishment or sewn on clothing (Swanton 1946:252).

The two artifacts which constituted the second category were fashioned from the columella of large, marine gastropods. The columella, which is the thick, inner longitudinal column of shell of a univalve, was sectioned and then each section was probably rubbed into shape on a hard stone (Adair 1775:170; Lawson 1860:316). Both these specimens were highly polished and had been biconically drilled through the longitudinal axis of the columella. One of them (USN 4124) is globular and has a beige nacre. The other (USN 2321) is slightly cylindrical and has a purple nacre. Marine conch or whelk beads were used by the historic Indians as ornaments (Lawson 1860:311-317; Swanton 1946:252), and strings of these beads constituted the shell money known as Peak, wampum, or Roanoke (Adair 1775:169). Wampum was used as an exchange medium to purchase "skins, furs, slaves, or anything the Indians have" (Lawson 1860:316).

The third category of perforated artifacts contains two shell pieces. One of these (USN 7228) is probably a pendant or gorget fragment which has been cut, perforated, and engraved. The kind of mollusc (univalve or bivalve) from which this artifact was manufactured can not be determined. An oval-bar design was engraved on one side of the shell. The other artifact (USN 4140) is the right valve of an unidentifiable bivalve. The pseudocardinal and the lateral teeth were smoothed down, and an oval perforation was drilled near the posterior edge from the interior of the valve. The anterior-ventral corner of the specimen appears to have been intentionally cut. Shell pendants and gorgets, like the conch shell beads, were often mentioned by early travelers as ornamental articles of the Indians (Lawson 1860:315; Adair 1775:171).

Group IV contained the largest number of shell artifacts: 45 pieces of cut shell, which is 66 percent of all the shell artifacts. The only modification on the freshwater bivalve fragments was one or more, usually straight cuts across the shell valve. The specimens had from one to four different cuts. Neither the pseudocardinal teeth nor the lateral teeth had been worn down on any of the valves. Other reports concerning shell artifacts mention residual categories of cut shell (Black 1967:463; Parmalee et al. 1972:7; Curren 1979:208), but these references do not fully describe what portions of the shell valve were found in the residual category. Sometimes it is impossible to identify precisely what portion of the valve is present because the shell fragment lacks the interior features such as the pseudocardinal teeth, lateral teeth, muscle scars, and the parallel line. Eleven of the forty-five pieces of cut shell from the Lubbub Site would fit into this category. The remaining pieces of cut shell could be divided into five subgroups that included residual products which were similar portions of the bivalve.

The first subgroup contained 11 triangular fragments of cut shell. These triangular pieces had been produced by cutting one line diagonally from either just posterior to or just anterior to the pseudocardinal teeth to approximately the midpoint of the valve, and by cutting another line from just posterior to the lateral teeth to the midpoint of the valve. Nine of these artifacts had a grayish tint resulting from burning.

The second residual category contained six specimens which had been modified in a manner similar to the above group but were rectangular in shape. The valves were all cut in the following fashion: (1) a cut was made from just anterior to the lateral teeth to a midpoint of the valve directly below the

anterior point of the lateral teeth; (2) a cut was made from just posterior to the lateral teeth to a midpoint of valve directly below the posterior end of the lateral teeth; and (3) a cut was made from one of the midpoints to the other. All of the specimens were slightly burned.

Six specimens constituted the third residual category, and these valves basically followed the following pattern: a cut was made from below the anterior adductor scar across the valve to a point below the posterior end of the lateral teeth, and a cut was made from the dorsal edge of the valve near the posterior end of the lateral teeth to where the first cut terminated. On one specimen the lateral teeth had been cut off. Three of the valves had been scorched.

The fourth category was composed of specimens represented by the anterior one-third of their valves. Six artifacts were included in this category, and all but two of them still retained their pseudocardinal teeth. From one to four cuts had been made on the valves, and four of the valves had been slightly burned.

Five specimens were grouped in the fifth residual shell category. All of them represented the posterior one-fourth of the bivalve shell, and each specimen had one or two cut edges. This portion of the valve contained the posterior adductor muscle scar and in three of the specimens, part of the lateral teeth was also included. One of the valves had been burned.

The cut edges of the bivalves were made perpendicular to the valve and the edges of the cuts were regular and smooth. Sometimes the interior edge of the shell was jagged. This may have resulted during the cutting process when the workman had deepened a groove and then just tapped the center with a hammmerstone which would have splintered the underneath side (Woodward 1936:121). The bivalves which had been cut were predominantly those species which had a thin shell. The burning of half of the cut shell by-products may have occurred after the valve had been cut, but also may have been an intentional act to make the valve easier to cut. These residual fragments of bivalve shell probably resulted from the manufacture of items which would be included in the shell artifacts in Groups II and III.

Only two shell artifacts, the conch or whelk shell beads, were manufactured from non-local molluscs. Large, marine gastropods would have been available from the gulf coast, approximately 200 miles south of the site. The beads could have been traded into the area as either finished products, possibly part of a shell money string, or as an unfinished product. Brame (1921:26) references the Spanish explorer Cabeca de Veca [sic] who stated that the unfinished columella of marine gastropods was traded from the coast to the interior in exchange for skins, flint, and stone items. The local freshwater bivalves and univalves could have been collected in the Tombigbee River and its tributary streams.

Even though more than 95 percent of the shell artifacts uncovered during the 1978-1979 field season at Lubbub Creek were manufactured from local invertebrates, the majority of the total shell artifacts known from the Lubbub Creek Archaeological Locality were not made out of local mollusc shell. Combining previously analyzed information (Curren 1979) with data included in Table 9, 499 shell artifacts (79 percent) were fashioned from marine

gastropods, and 131 artifacts (21 percent) were manufactured from local mollusc species. All of the marine shell specimens at Lubbub Creek were associated with Mississippian features or burials. However, when the information from other sites excavated in the Central Tombigbee River Area (Curren 1979) is considered, marine invertebrate objects were found in association with Woodland as well as Mississippian debris, and when the data from all the periods are combined, 99 percent of all the marine shell artifacts from these sites were found in burials. Within the burial context, associations could not be demonstrated between either shell artifacts and the age of the individual at death or shell artifacts and the estimated sex of the individual (Curren 1979:194).

It becomes apparent that the type of units excavated on sites in the Central Tombigbee River Area will determine to some extent the types of mollusc shell artifacts that are recovered. The marine shell artifacts were associated primarily with the burials. The artifacts fashioned from the local mollusc species were associated with burials only if the mollusc species was one of the freshwater snails (Goniobasis cf. pupaeformis or Anculosa cf. brevispira), or if the artifact was a pendant or a pearl. If the local mollusc shell artifact was a "hoe," "scraper," or cut shell by-product, then it always was found within a context other than a burial (feature, structure, or midden).

In summary, although neither the most numerous raw material for the manufacture of artifacts nor the most important food resource, the molluscan remains in the Lubbub Creek Archaeological Locality have provided important data about the lives and diet of the prehistoric inhabitants there: (1) Freshwater mussels were collected during the summer and early fall months primarily from mussel beds located on gravel and sand bars in the Tombigbee River. (2) There does not appear to be any significant change in the exploitative strategy used to gather mussels by the prehistoric populations from 800 A.D. through 1500 A.D. The shellfish were gathered in direct proportion to their abundance and availability in their riverine habitats. The refuse remains indicated a preference by the inhabitants for the smaller sized species and the younger specimens of the larger species. (3) Shellfish do not provide as many calories per unit of meat as do the other animals exploited by the prehistoric populations, but mussel meat did add to the diet some necessary nutrients: iron, calcium, and phosphorus. (4) Freshwater bivalves and freshwater and marine univalves provided the raw material for the manufacture of utilitarian and ornamental artifacts. The marine gastropods were fashioned into valued decorative items, which could have been used as a medium of exchange. The local bivalves were made into utilitarian items such as scrapers and digging implements, and both freshwater bivalves and univalves were made into ornaments.

CHAPTER 6. BIOCULTURAL ANALYSES OF HUMAN SKELETAL REMAINS FROM THE LUBBUB CREEK ARCHAEOLOGICAL LOCALITY

Mary Lucas Powell

INTRODUCTION

During the course of the Phase II and III excavations, 40 human burials which comprised 100 individuals were recovered from the Lubbub Creek Archaeological Locality. Two burials had been recovered during the Phase I testing of the site, and one additional burial was recovered in June, 1980, from the bank of the canal that had been cut through the site. A complete analysis of these 103 prehistoric inhabitants has not been attempted in the present report, due to limitations of analytical time and publication space. Rather, three specific aspects of the sample have been intensively investigated: its demographic profile; selected aspects of skeletal and dental pathology; and an analysis of intra- and inter-component mortuary patterning. The choice of these particular aspects was prompted by considerations of the nature of the sample (including the poor degree of bone preservation), their relevance to research questions of concern to the project as a whole (e.g. subsistence practices and social organization), and the research interests of the author.

Construction of a demographic profile is the most basic step in the biocultural analysis of any human skeletal series. This profile provides not only information about differential mortality with respect to age and sex, but also serves as a bioanthropologically relevant framework against which other research questions may be posed: for example, differential distribution of disease patterns within and between populations of differing lifeways.

Within the broad topic of paleopathology, five specific features were examined. Three of these were skeletal observations, and two were dental. They were:

(1) traumatic injury

(2) non-specific bony reaction to infection (periosteitis, osteitis and osteomyelitis)

(3) enamel hypoplasia

(4) porotic hyperostosis and cribra orbitalia

(5) dental and periodontal pathologies (caries and calcified plaque).

A third dental feature, occlusal dental wear, was also considered in this category; although not pathological per se, it may affect a population's experience with the other dental pathologies listed above. The first three features are frequently examined in skeletal series as generalized indicators of the success of biophysical adaptation to prevalent disease, plus nutritional and physical stresses. The latter three features reveal more specific information on dietary composition and methods of food preparation.

Analysis of the mortuary aspects of the sample include consideration of the spatial location of the burials relative to other cultural features and to specific areas of the site (e.g. mound and plaza area vs. residential areas), the disposition of the bodies (including evidence of processing and differential selection of skeletal elements for secondary deposition), and the presence and nature of associated grave goods. Such features mirror changing symbolic relationships between the dead and the living, as well as between sectors of the living population.

Both of these sections will include brief syntheses of biophysical and mortuary data from Phase II and III excavations in the Lubbub Creek Archaeological Locality with those collected by the University of Alabama Office of Archaeological Research in the Gainesville Lake in 1977. The general picture of health and disease, based on the above features, will be considered in relation to that of comparable prehistoric agricultural populations from Illinois (Lallo 1973) and the Georgia coast (Larsen 1980). The hypothesized decline in health from Mississippian to Protohistoric times in western central Alabama (Hill 1979) will also be investigated in the present series.

THE SAMPLE

Few, if any, skeletal series are ever considered perfect samples by their analysts. The drawbacks of the present sample include its generally poor bone preservation, the highly differential representation of skeletal elements due to aboriginal mortuary practices, and the paucity of associated grave goods or other archaeological criteria by which to assign each burial securely to a period within the Summerville phase.

These deficiencies are offset by numerous positive attributes of the sample, namely its size, temporal distribution, and demographic balance. The general excellence of the archaeological context within which this sample has been considered is another strong point of great importance. When the present sample is combined with that recovered from the site during the 1977 excavations, the wide range of bioarchaeological variability displayed within this larger sample suggests that a majority of the actual variation at least has been sampled.

Of the 43 human burials recovered from the site area during the Phase II-III excavations, 4 could not be assigned to a particular cultural component. They have been included in the tabulations in Appendices A and B to this chapter, but not in the analyses of paleopathologies and mortuary patterning.

Appendix A presents a tabulation of demographic and mortuary data for the 43 burials. Appendix B contains a tabulation of skeletal elements present for the 103 individuals included therein.

METHODS

Demography

Age estimations for subadult individuals were based upon observations of dental calcification and eruption (Ubelaker 1978), degree of epiphyseal closure and long bone length (Bass 1971; Krogman 1973). No attempt was made to estimate the sex of individuals below the age of 17 years at death because such estimates are generally considered unreliable due to incomplete pelvic maturation.

Of the adult individuals, only a very few could be placed into the ten-year age categories which were the original research goal. These categories were based upon observations of degenerative changes on the sacro-iliac aricular surface of the pelvis (C. Owen Lovejoy, personal communication). No pubic symphyses were preserved adequately for observation of age-related changes. The virtual absence of any other general macroscopic criteria useful for the rough seriation by age of skeletal samples (e.g. vertebrae and long bone joint surfaces, for the observation of age-progressive osteophytosis and osteoarthritis) forced reliance upon endocranial suture closure and occlusal dental wear for seriation into "younger" and "older" adults. The intra- and inter-population variability exhibited by these two criteria has been well documented (Brooks 1955; Krogman 1973; Acsadi and Nemeskeri 1970). However, the condition of the sample dictated their reluctant utilization in this analysis.

Estimates of sex for adults were based upon a combination of metrical and morphological observations. Few skeletal individuals possessed pelves adequate for analysis of key morphological features: pubic shape, sciatic notch configuration, and general robusticity relative to size (Washburn 1948; Phenice 1969; Bass 1971). Cranial features such as robusticity of mastoid processes, occipital and brow regions, lateral diameter of the mandible head, and morphology of the chin (Bass 1971; Krogman 1973) were considered when possible.

The most frequently available postcranial measurements useful in sex estimates were taken from the femur: vertical head diameter and midshaft circumference. The utility of these two measurements has been demonstrated repeatedly (Acsadi and Nemeskeri 1970; Bass 1971; Krogman 1973; Black 1977). The latter displays more inter-population variability than the former, but when graphed for this sample, displayed a bimodal distribution which agreed well with the sex estimates based upon cranial features for many of the same individuals. The majority of sex estimates for adult members of the Summerville IV subsample were based upon this latter measurement alone because no other criteria were available due to epiphyseal fragmentation, widespread absence of crania, and the uncertainty of 'reassembling' discrete individuals within the large ossuary (USN 7480). These latter estimates must be therefore considered only "probable," as must any estimate based upon a single criterion, even one yielding a tested accuracy of 85-90 percent (Black 1977).

[illegible]

[illegible]

Traumatic injuries were identified by the presence of scars on bony surfaces and calluses indicating healed fractures. Evidence of injury from human violence (e.g. projectile points embedded in bone or located within vital areas of articulated skeletons) was also sought.

The normal nonspecific inflammatory response displayed by bone to invasion by pathogenic microorganisms is traditionally classified according to the primary locus of infection. Osteomyelitis refers to infection of the marrow cavity, periosteitis to inflammation of the periosteal membrane, and osteitis to inflammation of the bone tissue itself. Inflammation is usually not strictly localized and frequently spreads from one component to another (Steinbock 1976).

Of these three varieties of generalized response, periosteitis is usually the most frequently observed in skeletal series. It may occur in mild form in response to fairly minor localized soft tissue injuries as well as in more severe manifestations of general systemic infections (Cook 1980). The formative mechanism is the same in both situations. Periosteal elevation results from the intracellular oedema intrinsic to inflammatory response; it encourages subperiosteal deposition of new "woven" bone upon the underlying surface of the bone. As the infection recedes and healing progresses, this rough-textured bone is gradually remodeled into smooth or lamellar bone and may appear in old well-healed cases only as slight surface irregularities resembling deposits of melted wax.

The presence or absence of inflammatory reaction was noted for each long bone and cranium observed in the sample. Periosteitis, when present, was scored with the aid of a system based on that developed by Cook (1980) for her investigation of endemic periosteal reaction in Illinois Hopewell skeletal series.

(1) Location of lesion on bone (localized or generalized):
- A = less than one-third of the area involved
- B = one-third to two-thirds of the area involved
- C = more than two-thirds of the area involved

(2) Degree of infectious involvement:
- 1 = cortex striated or pitted but no subperiosteal deposition
- 2 = subperiosteal deposition less than 3 mm thick
- 3 = subperiosteal deposition more than 3 mm thick, resulting in notable expansion of shaft diameter.

(3) Status of infectious involvement:
- FB = fiber bone, indicative of active infectious deposition
- SC = sclerotic bone, indicative of quiescent or healing lesion.

(4) Aspect of the bone involved:
- M = medial
- L = lateral

A = anterior
P = posterior

Scoring of periosteal involvement in human skeletal series has displayed little uniformity in past research. Some investigators, for example, Lallo (1973), have recorded several stages of involvement prior to and involving subperiosteal deposition; others have adopted a more elegant approach, for example, Cook (1980). The inclusion of a pre- or non-depositional stage permits general comparison with data reported by a wider range of researchers than does a system restricted solely to consideration of location and degree of deposition. As Cook (1980) has noted, striating and pitting of the cortex does signal some disruption, however minimal and from whatever source, of the normal vascularization of the periosteum, and thus should be considered in pathological observations.

Porotic hyperostosis and cribra orbitalia are two pathological conditions affecting, respectively, the bones of the cranial vault and the superior and lateral walls of the orbits. Clinical and experimental evidence has indicated that both conditions may result from a normal physiological response to hemolytic anemia (whether genetic, parasitic, or dietary in origin): expansion of the hemopoetic diploe of the cranial bones to facilitate increased red blood cell production (Steinbock 1976). In severe cases the outer table of the cranial bones is eroded by this expansion, producing the "honeycomb" appearance which, with increased bony thickness, characterizes these conditions.

Each cranium in the sample was examined for the presence of porotic hyperostosis and cribra orbitalia. The former condition was scored as present only if the following criteria were met:

(1) the affected portion of the vault exceeded 9 mm in thickness

(2) the outer table displayed marked osteoporosis, with foramina larger in diameter than those of pinpoint size.

The latter condition was scored as present if foramina appeared in the orbit walls. The location of such foramina was also noted.

Dental Pathologies

Dental wear is essentially a normal, non-pathological process, resulting from a combination of abrasion (erosion of the enamel from contact with extraneous materials) and attrition (erosion from contact with adjacent or opposing teeth). The rate and degree of occlusal wear experienced by a population may, however, directly affect its experience with clearly pathological conditions such as dental caries. For this reason, it is [illegible] here under the general heading of paleopathology.

[illegible] pathology [illegible] tooth wear may also shed light on techniques of [illegible] employed by prehistoric populations which enjoyed similar [illegible] Pueblo [illegible] who both consumed large [illegible] of starchy domesticated plant foods but processed them by different methods (e.g., pounding [illegible] maize in wooden mortars as contrasted with grinding [illegible] stone metates) display strikingly different rates and degrees

of wear (Leigh 19[illegible]; Bentzen 192[illegible]; Powell and Rogers 19[illegible]).

Dental wear was scored on each permanent molar [illegible] the system developed by Scott (1979b). This system, designed for use on samples [illegible] display generally light occlusal wear, incorporates five stages [illegible] total of ten which record erosion of the dental cusps from their pristine state at eruption, and five additional stages which record progressive exposure of secondary dentin on each of the four quadrants of the molar teeth.

Each deciduous and permanent tooth in the sample was examined for the presence of two categories of dental pathology: dental caries and calculus deposits (the latter commonly known as "tartar"). Dental caries is defined as a "disease of the calcified tissues of the teeth resulting from the actions of microorganisms on carbohydrates, characterized by decalcification of the inorganic portions of the tooth and accompanied or followed by disintegration of the organic portions" (Dorland 1965). In populations unable to halt this tissue destruction by medical intervention, severe dental caries contributes to a high rate of antemortem tooth loss. The severe abcesses which accompany such destruction may lead to general systemic debilitation through malnutrition and septicemia. These conditions in turn lower the energy available to the afflicted individual and reduce the individual's resistance to other diseases and environmental stresses.

Clinical research (Bibby 1961) has linked high-carbohydrate foods, especially those with soft textures, to increased oral counts of the cariogenous <u>Lactobacillus acidophilus</u>. However, the presence of large numbers of these microorganisms does not automatically elevate the frequency of caries throughout the dental arcade in a uniform manner. The epidemiology of dental caries in a population sample rests on the dynamic interaction of three factors: (1) a specific pathological agent (cariogenous bacteria); (2) environmental conditions which promote or discourage carious activity; and (3) host susceptibility, which includes both physiological and morphological features. The larger, more complex posterior teeth stand at higher risk from carious attack because pits and fissures on their occlusal surfaces function as efficient traps for food particles.

The methods developed by Moore and Corbett (1971) for the analysis of dental caries have been employed here with slight modifications. Each tooth was examined on all surfaces. Only those cavities which would admit the tip of a dental probe were scored as carious (to eliminate false scoring of discolored but intact enamel). Each lesion was classified as to surface location:

(1) <u>pit and fissure</u>, located on the occlusal surfaces of premolars and molars, as well as on molar buccal and lingual pits or grooves;

(2) <u>interproximal</u>, located at the point of contact between adjacent teeth;

(3) <u>cervical</u>, located at the cementum-enamel junction;

(4) <u>smooth surface</u>, located on smooth buccal or lingual surfaces;

(5) root, located on the root below the cementum-enamel junction.

The occurrence of caries at each location was expressed as a ratio of carious to total observed surfaces. Prevalence rates were calculated separately for each tooth type as a percentage of the total teeth present in each type.

Empty tooth sockets which displayed evidence of resorbtive remodeling were scored by tooth type, and their proportion to observed sockets calculated. Both of these features, caries and resorbed sockets, should be viewed as stages of expression of the same pathological situation, the invasion of the tissues within or around the tooth by pathogenic microorganisms. Infection of the pulp cavity may also be occasioned by heavy occlusal wear or traumatic fracture.

Each erupted deciduous and permanent tooth was examined for the presence of calcified dental plaque. Observed deposits were scored as "mild" (stage 2, isolated spots), "moderate" (stage 3, coalesced deposits), or severe (stage 4, three-dimensional deposits).

The final set of dental observations measures generalized stress rather than wear and dental disease. This feature, enamel hypoplasia, is produced by acute interruptions in normal enamel development. Clustered patterns of lesions formed on the teeth of many individuals in a sample at the same developmental stages may suggest clustered stress episodes, such as seasonal nutritional deficiencies or culturally-directed processes such as weaning. These lesions appear macroscopically as smooth or pitted transverse grooves on the buccal surfaces of the teeth. They are formed by alterations in the formation of the enamel by the ameloblasts, the sensitivity of which to metabolic stress from disease, nutritional deficiencies, and other factors, has been verified by clinical experimentation (Clarke 1978). If normal enamel formation is resumed at the cessation of the stress episode, the final size and morphology of the tooth typically are not affected.

Following the technique outlined by Swardstedt (1966), the age of the affected individual at the formation of each observed lesion was calculated. This was accomplished by measuring the distance, in millimeters, from the center of each lesion to the cementum-enamel junction and matching this figure with a standardized scale of enamel development. The incidence of lesions formed within the first twelve postnatal six-month developmental periods was computed for the population as a ratio between the number of individuals with lesions formed during each period and the total number of individuals with [illegible] from that period. To eliminate 'false positive' scores [illegible] activity not reflecting [illegible] hypoplastic lesions [illegible] teeth of an individual [illegible]

[illegible] the sample of [illegible]
[illegible] bone [illegible] and

TABLE 9

[illegible]valence of Enamel Hypoplasis in Permanent Incisors and Canines

[illegible]	N Individuals with Lesions	N Individuals Observed	%
[illegible]	0	30	0.0
[illegible]	0	30	0.0
[illegible]	1	30	3.3
[illegible]	1	27	3.7
[illegible]	2	27	7.4
[illegible]	9	26	34.6
[illegible]	15	26	55.7
[illegible]	15	25	60.0
[illegible]	11	23	47.8
[illegible]	6	20	30.0
[illegible]	3	16	18.8
[illegible]	0	10	0.0

[illegible] advantageous [illegible] within [illegible] with [illegible] nutritional [illegible] deprivations as well.

Enamel Hypoplasia

No hypoplastic lesions were observed on the 31 deciduous incisors and canines in the Mississippian subsamples. Data on the prevalence of hypoplastic lesion formation in the 154 permanent incisors and canines in the sample during each six-month period from birth to six years are presented in Table 9. This prevalence is expressed as the percentage of individuals affected rather than as the number of lesions formed within each period because of the particular appearance of arrested enamel formation in the Lubbub sample. These developmental disturbances appeared most typically as amorphously distributed pits rather than as discrete lines on the buccal surfaces of the teeth. It seemed more reasonable therefore to record that a specific portion of a tooth (e.g. the enamel formed between 3.0 and 4.0 years) bore such indications of disrupted growth.

The great majority of the lesions noted on these teeth were of a very mild form, suggesting that whatever systemic disturbances produced them were neither severe nor of long duration.

Discussion

The general picture of health and disease for the prehistoric populations who lived in the Lubbub Creek Archaeological Locality derived from the present skeletal series provides an interesting contrast to the conclusions drawn by recent researchers (Lallo 1973; Larsen 1980) concerning biophysical adaptations of other Mississippian populations. Definitive statements on this question with respect to Alabama's prehistoric agriculturalists must await extensive comparisons with ancestral and descendent samples, and, for this reason, are far beyond the scope of the present report. Nonetheless, the overall state of health of the Lubbub Creek population, as indicated by the generally low levels of traumatic injury, serious infectious reactions, and developmental and degenerative disorders of the dentition, prompts the tentative suggestion that perhaps the Mississippian adaptation represented an optimization of human ecological relationships in the Southeast.

Retrospective assessments of the health of prehistoric populations should be based upon observations of numerous features which measure various aspects of human ecological adaptation. Reliance upon one feature alone may lead to faulty interpretations due to the phenomenon of "parallax" in paleoepidemiological investigations. Observations which would reasonably lead to one conclusion if drawn from a living population must be calculated in a somewhat different manner when drawn from skeletal series. For example, a very low prevalence of infectious reactions in a skeletal sample might immediately suggest a high level of health. However, localized or systemic infections from numerous microorganisms (e.g. endogenous staphylococci which account for 90 percent of suppurative osteomyelitis) may not provoke radiographically detectable bone reactions for many days after inflammation of soft tissues is evident (Greenfield 1975). Death might occur from septicaemia before infection would be detectable from skeletal evidence. The proportion of healed or quiescent infective reactions to those active at time of death

TABLE 8

Distribution of Resorbed Sockets by Tooth Type

Archaeological Site	Molars		Others	
	N	%	N	%
1 Pi 33[1]	38/39	97.4%	1/39	2.6%
Summerville I-III	30/34	88.2%	4/34	11.8%
Summerville IV	2/2	100.0%	0/2	0.0%
Caddo[2]	66/77	85.7%	11/77	14.3%
1 Pi 61[1]	29/54	53.7%	25/54	46.3%
Fourche Maline[2]	46/48	95.8%	2/48	4.2%

[1]Pearce and Mayfield, 1978.
[2]Powell and Rogers, 1980.

TABLE 7

Analysis of Caries by Tooth Type

Archaeological Site	Incisors		Canines		Premolars		Molars	
	N	%	N	%	N	%	N	%
1 Pi 33	0/49	0.0%	0/49	0.0%	9/49	18.4%	40/49	81.6%
Summerville I-III	1/65	1.5%	2/65	3.1%	9/65	13.8%	53/65	81.5%
Summerville IV	00/00	0.0%	2/21	9.5%	3/21	14.3%	15/21	71.4%
Caddo[1]	17/403	4.2%	12/403	3.0%	67/403	16.6%	307/403	76.2%
1 Pi 61[1]	2/68	2.9%	1/68	1.5%	12/68	17.7%	53/68	77.9%
Fourche Maline[2]	0/77	0.0%	1/77	1.3%	8/77	10.4%	68/77	88.3%

[1]Pearce and Mayfield, 1978.
[2]Powell and Rogers, 1980

TABLE 6

Analysis of Caries by Loci

Archaeological Site	Pit and Fissure		Interproximal		Cervical		Smooth Surface		Root	
	N	%	N	%	N	%	N	%	N	%
Summerville I-III	29/65	44.6%	21/65	32.3%	11/65	16.9%	4/65	6.2%	00/00	0.0%
Summerville IV	15/21	71.4%	5/21	23.8%	00/00	0.0%	1/21	4.8%	00/00	0.0%
Caddo[1]	278/403	69.0%	64/403	15.9%	39/403	9.7%	19/403	4.7%	3/403	0.7%
Fourche Maline[1]	42/77	54.5%	32/77	41.6%	2/77	2.6%	1/77	1.3%	0/77	0.0%

[1]Powell and Rogers, 1980.

TABLE 5

Prevalence of Dental Caries and Ante-mortem Tooth Loss

Archaeological Site	% of Carious Individuals		Mean N Caries per Individual		Mean N Caries per Tooth		Mean N Teeth Lost per Individual		% of Individuals with Ante-mortem Tooth Loss	
	%	N	X	N	X	N	X	N	%	N
1 Pi 33[1]	92.3%	12/13	3.77	49/13	.16	49/309	3.0	39/13	61.5%	8/13
Summerville I-III	50.0%	15/30	2.17	65/30	.14	65/472	2.29	32/14	71.4%	10/14
Summerville IV	56.3%	9/16	1.30	21/16	.09	21/244	.50	2/4	50.0%	2/4
Caddo[2]	90.6%	48/53	7.60	403/53	.43	403/928	1.45	77/53	37.7%	20/33
1 Pi 61[1]	66.7%	22/33	2.06	68/33	.09	68/782	1.64	54/33	39.4%	13/33
Fourche Maline[2]	30.4%	21/69	1.12	77/69	.09	77/874	.72	48/67	25.0%	17/67

[1]Pearce and Mayfield, 1978.
[2]Powell and Rogers, 1980.

TABLE 4

Mean Wear Scores for M1 - M2 Pairs

Site	Mean M1	s.d. M1	Mean M2	s.d. M2	Mean Differences (M1 - M2)	N Pairs
Maxillae						
Indian Knoll[1]	26.7	5.3	19.2	5.6	7.5	29
Campbell[1]	19.3	4.1	15.1	2.2	4.2	32
Hardin[2]	15.4	2.7	13.2	2.4	2.2	30
Lubbub[2]	15.8	2.9	13.4	2.7	2.4	12
Mandibles						
Indian Knoll	27.4	4.3	20.1	5.1	7.3	24
Campbell[1]	17.6	2.8	14.6	2.2	3.0	34
Hardin[2]	17.4	3.8	15.1	2.4	2.3	19
Lubbub[2]	16.3	3.2	11.8	3.6	4.5	8

[1]Scott, 1979a.
[2]Summerville subphases I through IV only.

the Hardin and Lubbub scores by a factor of three (with the exception of the Lubbub mandibles)

Dental Caries and Ante-Mortem Tooth Loss

Tables 5, 6, 7, and 8 present data on dental caries and ante-mortem tooth loss in the Lubbub sample. Comparative data from the Summerville I sample excavated in 1977 and from the Miller III site at 1Pi61 excavated at that time are also presented (Pearce and Mayfield 1978). Additional comparative data have been drawn from Caddo (Western Mississippian) dentitions from southwest Arkansas and Fourche Maline (Archaic/Woodland transition) dentitions from Oklahoma examined previously by this researcher (Powell and Rogers 1980).

The frequency of caries in the 1979 Lubbub sample, which came from the western one-half of the site, was considerably lower than that reported for the individuals excavated in 1977 from the eastern area of the site. The overall frequency of caries among the western sample more nearly resembles that of the Late Woodland individuals at 1Pi61 than other Mississippian samples. The same trend is evident for mean number of caries per individual and per tooth.

The unusually low number of individuals with ante-mortem tooth loss in the Protohistoric, Summerville IV subsample reflects the strong sample bias toward juvenile rather than adult dentitions. This bias is probably also responsible in part for the lower frequency of caries in that subsample. In fact, that feature displayed a clear age-accumulative bias for all observations made in this analysis. In the Summerville IV sub-sample, only 4 deciduous teeth (out of 114 in a total sample of 716 teeth) were affected by caries.

Tables 6 and 7 reveal the influence of dental morphology upon the incidence of caries within the human dental arcade. The fissures of the larger posterior teeth provide loci for the majority of the carious lesions observed. Only in the Fourche Maline sample had occlusal wear removed this source of differential caries experience, as indicated by the more equitable distribution of caries with respect to loci in that sample.

The predominance of resorbed sockets in the molar regions of the dental arcade reflects the greater susceptibility of that tooth type to carious destruction. Even the Protohistoric subsample displays this trend, despite its small size (Table 8).

Calcified Dental Plaque

Calcified dental plaque did not pose a major problem for periodontal health of the populations that lived in the Lubbub Creek Archaeological Locality. The mean score for this condition was 1.88 for maxillary teeth and 2.14 for mandibular teeth in the earlier subsamples. The lower mean scores calculated for the Protohistoric subsample (1.57 maxillary and 1.70 mandibular) reflect once again the younger mean age of this subsample. When adult dentitions alone are considered, the mean scores rise to 2.10 and 2.53 for the former and 1.39 to 1.95 for the latter subsamples. Even deposits scored as stage 3 were rarely large enough, except in a very few cases, to promote gingival recession. The consistently higher scores for the mandibula

TABLE 3

Periosteitic Involvement of Long Bones

Bone	Stage 1		Stage 2		Stage 3		Bones of This Type All Bones Affected		Percent of All Bones of This Type Affected		
Tibia	34	(6[illegible]8[illegible])	19	(34.5%)	2	(3.7%)	55/90	(61.1%)	Tib	55/118	(46.6%)
Fibula	4	[illegible]	8	(61.5%)	1	(7.7%)	13/90	(14.4%)	Fib	13/118	(11.0%)
Femur	17	(8[illegible] 5[illegible])	2	(10.5%)	0	(0.0%)	19/90	(21.2%)	Fem	19/141	(13.5%)
Humerus	2	(100.[illegible])	0	(0.0%)	0	(0.0%)	2/90	(2.2%)	Hum	2/121	(1.7%)
Radius	0	(0.0%)	1	(100.0%)	0	(0.0%)	1/90	(1.1%)	Rad	1/85	(1.2%)
Ulna	0	(0.0%)	0	(0.0%)	0	(0.0%)	0	(0.0%)	Ulna	0/85	(0.0%)
TOTALS	57	(63.4%)	30	(33.3%)	3	(3.3%)	90	(100.0%)		90/668	(13.5% AVG)

[illegible] and [illegible] had numerous patches of overlapping deposition. The [illegible] was completely obscured by newly deposited trabecular bone.

Table 3 presents frequencies of periosteitic involvement by stage of severity for the six most commonly affected skeletal elements in the sample. The tibia displayed infectious reaction far more frequently than all of the others combined, a trend noted in other skeletal series (Lallo 1973; Larsen 1980). Of the 95 individuals observed, 38 (36.8 percent) displayed at least stage 1 involvement of at least one of these bones. However, only 4 (10.5 percent) of these cases were apparently still active at death. Adults accounted for 88.5 percent of the observed cases of infectious reaction. This association of frequency and age is not surprising, since evidence of infectious reaction in bone is in a sense age-accumulative in a reasonably healthy population where the majority of people recover from such pathological invasions. Total disappearance of all traces of infectious involvement through remodeling of the bone may lag years behind recovery in the clinical sense.

One of the two Miller III individuals displayed periosteitic involvement. In the Early and Mature Mississippian subsamples, eleven of 31 individuals (35.5 percent), all of whom were adults, displayed this condition. The Protohistoric subsample provided 65.8 percent of all affected individuals; this group included three subadults.

Severity of involvement was generally moderate. None of the earlier Mississippian bones displayed stage 3 (severe) reactions; those affected were equally divided between stage 1 and stage 2 manifestations. The Protohistoric subsample *included 3 bones (4.9 percent)* with stage 3 involvement and 15 (24.6 percent) with stage 2 involvement. Well over half of the subsample of affected bones (43 out of 61, or 70.5 percent), however, were scored at stage 1. In all subsamples combined, 63.3 percent (57/90) of affected bones displayed mild involvement, 33.3 percent (30/90) showed moderate involvement and 3.3 percent (3/90) manifested severe infection. Within the earlier subsamples, the sex ratio of affected individuals was roughly equal: 5 females and 7 males. Individuals within the later subsample for which sex could be determined were rare, but the observed sex ratio was similar: 5 females and 8 males.

DENTAL ANALYSES

Dental Wear

Mean wear scores, calculated according to the method outlined by Scott (1979b) for pairs of first and second permanent molars from the combined Summerville subphase samples are presented in Table 4. Comparative data are presented for similar pairs from an Archaic (Indian Knoll) sample and two Mississippian samples from Missouri (Campbell) and Michigan (Hardin) (Scott 1979a). Predictably, the Lubbub scores closely match those from their culturally contemporaneous samples. Mandibular teeth displayed slightly faster rates of wear than did their maxillary partners in Hardin and Lubbub dentitions, a reversal of the respective rates displayed by the Campbell dentitions. This trend is more pronounced in the Mississippian than in the Archaic samples. Mean differences in wear scores for M1 and M2 in the Archaic dentitions are approximately double those for the Campbell dentitions and top

TABLE 2

Porotic Hyperostosis and Cribra Orbitalia

USN	Age	Sex	Condition	Summerville Period
5564	35-45	Male	Porotic hyperostosis	II-III
8123	30-40	Male	Porotic hyperostosis	II-III
1886	16-17	Unknown	Porotic hyperostosis	IV
6310	20-30	Unknown	Porotic hyperostosis	IV
3649	3-5	Unknown	Cribra orbitalia (?)	IV

suggested that healing had commenced during her lifetime. A second cranial injury was displayed by a young female aged 18 to 25 years from the ossuary (Section II, Adult II) who had apparently survived a depressed fracture at bregma.

Three individuals displayed fractures of the lower limbs; all had been healed for some time before their deaths. The right femur of a female (USN 4132) aged 30 to 39 years at death bore an unreduced fracture at midshaft. The inferior portion of the shaft was displaced anteriorly to the superior end, and the two had been united firmly by a large callus. An adult male from the ossuary (Section III, Adult III) aged 30 to 39 years had fractured the distal shaft of his left fibula, and this break was united by a large callus to the adjacent tibia. An adult right first metatarsal recovered from a pit (USN 4124) displayed extensive epiphyseal remodeling as the result of an old well-healed transverse crushing fracture. This injury had evidently occurred during adolescence, as the proximal epiphysis had been displaced causing lapsed fusion. The distal epiphysis had been greatly enlarged through callus formation, with slight reactive deposition evident on the shaft. No other human bones were associated with this single pathological element.

Paleopathology: Porotic Hyperostosis and Cribra Orbitalia

Table 2 contains data on the occurrence of porotic hyperostosis and cribra orbitalia in the sample. The very low prevalence noted (4/58 or 6.9 percent of crania observed for the former and 1/43 or 2.3 percent for the latter) suggest that iron deficiency was not a problem in Mississippian diets at Lubbub, and that parasitic infestation was not sufficient to cause widespread anemia.

Paleopathology: Non-Specific Infectious Reaction

Two of the ninety-five individuals examined (2.1 percent) displayed osteomyelitis. One was an adult female (USN 4132) whose osteomyelitis was a consequence of a fractured right femur shaft (see previous section on traumatic injuries). The other adult female displayed stage 2 periosteitis on both tibiae as well as possible osteomyelitic involvement of the proximal right femur shaft. Her expanded cranial vault also suggested mild porotic hyperostosis. Both adults were members of the earlier Mississippian communities. An adult right ulna from the ossuary displayed the fusiform shaft associated with chronic nonsuppurative osteomyelitis, but no definite diagnosis could be made in the absence of radiographic examination.

Five individuals bore traces of osteitis (5.3 percent). Two of the cases were the consequence of traumatic injuries. The distal metaphysis of an adult left fibula from the ossuary displayed patches of newly-deposited woven bone and a proliferation of bony spicules and deposits. The absence of cloacae and expansion of the affected shaft argue against osteomyelitic involvement. Two other long bones from the ossuary were affected by osteitis, but due to the nature of that feature, it was impossible to identify other bones belonging to these same individuals. An adult left ulna bore a small oval lesion on its shaft that apparently had healed before death. The most grossly pathological specimen in the entire sample was an adult left femur whose entire shaft, including the metaphyseal regions, had been expanded by exuberant bone deposition to double its original size. The cortex resembled rough tree bark

TABLE 1

Demographic Profile of Total Sample (N=103)

	Total Sample		Miller III			Summerville I-III			Summerville IV			Unknown		
	N	%	N	% of Subsample	% of Total Age Category	N	% of Subsample	% of Total Age Category	N	% of Subsample	% of Total Age Category	N	% of Subsample	% of Total Age Category
0-2 years	13	12.6%	0	0.0%	0.0%	6	18.2%	46.1%	6	9.4%	46.2%	1	25.0%	7.7%
2-5 years	11	10.7%	0	0.0%	0.0%	7	21.2%	63.6%	3	4.7%	27.3%	1	25.0%	9.0%
5-10 years	5	4.9%	0	0.0%	0.0%	1	3.0%	20.0%	4	6.2%	80.0%	0	0.0%	0.0%
10-18 years	4	3.8%	0	0.0%	0.0%	1	3.0%	25.0%	3	4.7%	75.0%	0	0.0%	0.0%
Total Adults	70	68.0%	2	100.0%	2.9%	18	54.5%	25.7%	48	75.0%	68.5%	2	50.0%	2.9%
Total N	103		2			33			64			4		

differential representation of skeletal elements frustrated efforts to place most adults into 10-year estimated age categories. As a result, all but the skeletons of children and infants have been grouped simply as "adults" in this table.

Only two individuals were assigned to the Miller III occupation. Both were adult females.

Of the 97 individuals assigned to the Mississippian occupation (Summerville I through IV), 32.0 percent died before the age of 18 years. When compared with Weiss' (1973) review of mortality in preindustrial skeletal and living populations, this subadult mortality rate is somewhat lower than expected for a sample of this nature. His data indicate that "overwhelming evidence places the rate of juvenile mortality among anthropological populations between 30 and 50 percent..." (Weiss 1973:49). Differential preservation of young subadult and adult skeletons (Angel 1967) and aboriginal mortuary programs which may result in different spatial distributions for various age groups (Cook 1974) may both contribute substantial bias to archaeological samples.

The observed subadult mortality among the Mississippian population in the Lubbub Creek Archaeological Locality, however, does conform well to that predicted by Weiss (1973:26): "...the general shape of human juvenile mortality is known: infant mortality is very high; mortality is still high but declining from ages one to five; then it decreases steadily until those from 10 to 15 years have the lowest mortality of all age classes." Of the 33 subadults in the sample, infants (0 to 2 years) account for 39.4 percent, children (2 to 5 years) for 33.3 percent, juveniles (5 to 10 years) for 15.2 percent, and adolescents (10 to 18 years) for the lowest percentage in the subsample, 12.1 percent. This age-progressive decline in mortality is also evident within the sample as a whole.

Subadult mortality in the Summerville IV subsample was more equitably distributed through the age classes than in the remainder of the Mississippian sample. Given the small sample size, no conclusions can be drawn at present concerning the possible significance of this deviation.

The adult sex ratio within the total sample is biased in favor of males (29 males to 21 females). No estimation of sex beyond an experienced 'hunch' was possible for 19 of the 69 adults, however, due to widespread absence of those same skeletal elements (pelves and crania) which would have facilitated finer estimates of adult age at death. Numerous adults for which sex could not be determined were represented only by very fragmented long bones; however, the gracility of many of these fragments suggests that the observed sex bias of the sample is apparent rather than real.

<u>Paleopathology: Traumatic Injury</u>

Of the 95 individuals with sufficient skeletal material for examination of traumatic injury, only 5 (5.3 percent) displayed evidence of such conditions. An a[illegible]e (USN 5458) aged [illegible]0 to 29 years at death bore on her right frontal a shallow groove, 41 mm in length, which ran obliquely from a point just posterior to the coronal suture to a point just anterior to the postorbital constriction of the vault. The rounded edges of the groove

[illegible]

The small sample size of the Lubbub data [illegible] not [illegible] statistical analysis. Methodological differences [illegible] recording schemes [illegible] by other researchers of other American populations [illegible] are discussed below in comparison with the Lubbub population [illegible] precluded statistical comparisons. The internal consistency in patterning of the Lubbub results suggests that they do reflect the general overall health status of the population sample under analysis and that this sample displayed reasonably good biophysical adaptation in its cultural-ecological niche. Statistical corroboration of these conclusions must, however, await analysis of a larger regional sample.

The low prevalence and mild manifestations of the three pathological conditions examined here, all of which are considered to be creditable general indicators of elevated levels of systemic stress - - enamel hypoplasia, porotic hyperostosis and cribra orbitalia - - suggest that such stresses were well absorbed by the Lubbub Mississippians. The vast majority of infectious reactions evident on bone were of the mildest sort recognized by the recording scheme. Subadults were affected less frequently than adults, and the majority of cases in both age groups involved the tibia, a bone whose disadvantageous location with respect to venous circulation and protective musculature may encourage increased periosteal vascularization in response to insult through trauma and localized or hematogenous infections. A definite bias toward tibial involvement in non-specific infectious reactions has been noted in several skeletal series (Lallo 1973; Larsen 1980).

Lallo (1973) noted a prevalence of 67.4 percent for infectious involvement in his mature Mississippian sample from Dickson Mounds. Frequencies for juveniles and adults were almost identical, and both doubled, trebled, and even quadrupled the rates observed for the same pathological response in the preceding Woodland and Mississippian-Acculturated Late Woodland populations. The high proportion of disarticulated remains in the Lubbub sample discouraged calculation of a simple population frequency rate. However, the percentage of infected tibiae (the most frequently affected bone in the sample) was 46.6 percent and as such was considerably lower than in the Dickson Mounds sample (84.0 percent). The great majority of the Lubbub cases (53/55 or 96.4 percent), when judged by cortical remodeling, were quiescent or healed. Over 60 percent of them were scored as stage 1, the mildest degree of reaction (Table 3). Severity of involvement was much higher in Dickson Mounds Mississippians; 61.5 percent of tibiae were scored as severely affected (Lallo 1973), whereas only 38.3 percent of the Lubbub tibiae displayed moderate to severe involvement.

Larsen (1980) reported periosteal reaction in 15 percent of the tibiae [illegible] prehistoric agriculturalists of coastal Georgia. This rate represented a marked increase over the frequency (4.6 percent) noted for preagriculturalists of the same region, yet it is less than one-quarter the rate reported by Lallo [illegible] one-third of that noted for the Lubbub sample. It seems probable that the recording scheme utilized by Larsen may have ignored the mildest manifestations tabulated in the other studies. On the other hand, the Illinois and Alabama Mississippians may have been subjected to additional

cultural and ecological stresses which exacerbated pathological involvements.

Various explanations have been advanced for the increase in prevalence of infectious pathologies in Mississippian populations when they are compared with their preagricultural or less intensively agricultural predecessors. This pattern has been noted in populations experiencing the Neolithic transition in many parts of the world (Armelagos 1967). Numerous features of the Mississippian lifeway would have tended to encourage increased levels of host-pathogen contact (Powell n.d.). Increased sedentism would have juxtaposed residential areas with wastes which supported infestations of insects and vermin. The rise in population density and in inter-community interactions through trade and ceremonial congregation would have facilitated pathogen exchange between groups and individuals of unequal resistance to localized strains of micro-organisms. Regularly scheduled exploitation of plants and animals would have intensified contacts between zoonotic pathogens and potential human hosts. All of these factors undoubtedly contributed in some measure to Mississippian infectious disease experience, which probably drew its heaviest contribution from those endogenous micro-organisms most frequently implicated in modern soft tissue infections which involve adjacent bones (Steinbock 1976).

With respect to hypoplastic defects of the permanent dentition, the clustering of high-risk periods at ages 3 to 4.5 years in the sample from the Lubbub Creek Archaeological Locality suggests increased population-wide levels of systemic stress during those years which affected successive generations at approximately the same developmental stage. One such recurrent source of nutritional stress which frequently affects young children of preindustrial agriculturalists is weaning from a diet enriched by maternal milk onto a diet high in nutrient-poor carbohydrates. The undernourished weanling may fall prey to macro- or micro-parasitic invasion, whose effects are synergistically promoted by poor nutrition (Scrimshaw 1964). Rose (1973) and Clarke (1978) have carefully considered the possible connections between such culturally patterned sources of systemic stress and certain developmental defects of the long bones and dentition.

The age-associated prevalence of hypoplastic lesions observed in the Lubbub sample suggests a somewhat later onset of systemic stress than in samples reported by those researchers from prehistoric agricultural populations in Arizona and Illinois. In the latter populations, the modal age of occurrence of hypoplastic lesions was between 2.5 and 3.5 years. If weaning stress was indeed a causal factor at Lubbub, births may have been spaced more widely than the 2 to 3-year interval common in modern non-industrialized agricultural groups (Howell 1977). Whatever their source, the [illegible] "fossilized" as hypoplastic lesions were apparently well buffered by the Lubbub subadult population because the observed deformations of the buccal enamel of the permanent dentition are not at all severe.

The prevalence and patterning of dental caries and antemortem tooth loss in the 1979 Lubbub sample (Tables 5,6,7, and 8) suggests a diet relatively high in carbohydrates but one not excessively so. The substantially higher proportion of carious individuals reported (Pearce and Mayfield 1978) from the subsample recovered in 1977 from the eastern cemetery may reflect intra-component (Summerville I) dietary differences. However, inter-observer differences in sample selection and lesion observation may equally be

responsible for the discrepancy. Cultigens, primarily maize, contributed significant proportions of carbohydrates to the Lubbub diet. Ethnographic data on methods of food preparation among Southeastern Indians (Swanton 1946) indicate that most vegetable foods were consumed in soft forms which would promote the formation of dental plaque. Oral bacteria within plaque deposits manufacture highly acidic wastes from such a diet, hence its decisively cariogenic nature (Hillson 1979). The diet of the majority of the Mississippians in the Lubbub Creek Archaeological Locality (with the possible exception of the easternmost subsample) seems to have resembled more closely in cariogenicity the diet of their indigenous Woodland predecessors (as represented by the 1 Piól sample) than that of other Mississippian populations (as represented by the Caddo). The patterning of caries with respect to loci and tooth type follows this regional tendency. The Caddo dentitions, as did the other two Mississippian samples presented for comparison in Table 4, displayed slightly heavier occlusal wear than did the 1979 Lubbub subsamples. The prophylactic effect of moderately heavy occlusal wear upon caries prevalence is clearly demonstrated by the Fourche Maline sample, whose wear scores doubled those for the Caddo (Powell and Rogers 1980).

A positive correlation between the very light dental wear and actual caries experience at Lubbub is suggested by the high prevalence and patterning of antemortem tooth loss in that sample. This loss was heavily concentrated in the molar region (Table 8); this same region provided the low wear scores. It seems probable that most if not all of these molars had been lost to carious destruction and subsequent abcessing. Evidence for other contributing causal agents, such as excessive occlusal wear which permitted pulp cavity invasion by pathogenic micro-organisms, traumatic tooth loss, deliberate evulsion for cultural purposes, and excessive calculus deposits which promoted periodontal disease, was not observed in the sample.

In a survey of caries experience in populations of varying subsistence strategies, Turner (1979) found that intensive agriculturalists displayed an average of 8.6 percent carious teeth, whereas groups who relied upon a more mixed economy (agriculture or horticulture combined with harvesting of wild plants and animal resources) were less caries-prone, with an average of 4.4 percent carious teeth. The Early and Mature Mississippian subsample from the Phase II and III excavations in the Lubbub Creek Archaeological Locality exceeds the former average (11.9 percent), and the Protohistoric subsample matches it precisely (8.6 percent). The difference between the caries experience of these two subsamples is most readily explained by the younger age structure of the latter.

Larson's (1980) caveat against hasty conclusions based on such percentages in his discussion of caries among preagricultural and agricultural Georgia coastal populations deserves repetition here. He noted that although the observed percentage of carious teeth (13.7 percent) in his agricultural sample suggests a very heavy reliance upon agricultural resources, abundant ethnographic and archaeological evidence exists for hunting, fishing, and gathering activity as well as agriculture in these populations. The same is true for the prehistoric inhabitants of Lubbub.

In an analysis of skeletal series from four Alabama River Phase sites in west central Alabama, [illegible] ([illegible]) hypothesized a decline in health from Mississippian to Protohistoric times which resulted from a change in

subsistence practices which produced "extreme nutritional stress." She based this hypothesis upon the high prevalence of porotic hyperostosis (58.8 percent) in her sample from site 1Tu4, a Protohistoric settlement with evidence of European contact. This exceptional frequency was not duplicated in her three other roughly contemporaneous but somewhat earlier series.

The prevalence of this condition (11.5 percent) in the Lubbub Protohistoric sample matched the lower three percentages reported by Hill. Only 2 of the 26 individuals with observable crania displayed evidence of porotic hyperostosis (Table 2). This frequency is no higher than that observed in the Early and Mature Mississippian subsample. One Protohistoric child displayed possible slight cribra orbitalia; however, the single orbit observed was quite fragmentary and the diagnosis is uncertain.

With respect to other skeletal and dental indicators of nutritional stress, the protohistoric, Summerville IV prehistoric inhabitants of the Lubbub Creek Archaeological Locality appeared only slightly less healthy than did their immediate predecessors. The percentage of individuals affected by periosteitic reaction (41.9 percent vs. 35.5 percent) and enamel units affected by hypoplasia (24.5 percent vs. 19.6 percent) are somewhat higher in the later subsample. However, the degree of severity for both conditions is essentially mild in both subsamples. Hill's suggestion that the sample from 1Tu4 may be idiosyncratic in its high frequency of nutritionally related pathologies seems to be a reasonable conclusion.

MORTUARY ANALYSIS

Recent analyses of mortuary patterns in archaeological samples unanimously have derived their justification from the basic assumption that observed distinctions between individuals in death reflect to some degree social distinctions experienced by those individuals in life (Binford 1971). These distinctions may be strikingly objectified, as in the case of Tutankhamen's golden treasure, or they may be more subtly delineated, as in the spatial distribution of a corporate descent group within a small Mississippian cemetery (Goldstein 1980). The final section of this chapter will be devoted to consideration of observed variation in demographic, formal, and spatial features of the mortuary sample from the Lubbub Creek Archaeological Locality. Comparisons will be drawn with the sample (somewhat different in nature) recovered from another portion of the site in 1977 and with ethnographic data relevant to the most recent aboriginal occupation. The purpose of such comparisons will be to investigate intra- and inter-component variations which might suggest changes through time in the social expression of perceived social differences among individuals.

Methods

The following features were examined in the analysis of mortuary patterning in the 39 burials which were assigned to the Miller III and Mississippian occupations:

(1) number of individuals in the burial;
(2) burial position (extended, semi-flexed or flexed);
(3) burial form (articulated or disarticulated);
(4) burial facility (pit, urn, etc.);

(5) orientation of the cranium;
(6) associated grave goods;
(7) location of the burial with respect to other cultural features;
(8) age and sex of each individual;
(9) skeletal elements present;
(10) cultural component.

Two single adult female burials were tentatively assigned to the Miller III component. This assignment was based primarily on body position, heavy dental wear, and location within areas of the site which contained dense evidence of that occupation. Neither diagnostic ceramics nor other artifacts were associated with these burials. Only one burial pit could be identified, a shallow oval conical pit containing Burial 3 (USN 1315) in Hectare 300N/-300E. Burial 2, Hectare 500N/-200E, was discovered eroding from the west bank of the canal cut through the site; it too was in the general vicinity of intensive Miller III occupation.

Three and possibly four of the thirty-five human burials recovered during the 1977 excavations east of the mound were assigned to the Miller III occupation. Their formal attributes closely resemble those in the present sample and were probably contemporaneous with them. The general paucity of Woodland burials (relative to Mississippian burials) lends support to the arguments presented elsewhere in this report concerning the seasonal nature of Woodland utilization of the site.

Fourteen burials were assigned to the Summerville I occupation, the most extensive in area on the bend (Chapter 8, Volume I). All were single primary interments (see Appendix A), the majority in shallow oval pits. All were located either near structures or within areas of intense activity as indicated by high densities of pits and postmolds. Six adult burials from this group were located within the northwest corner of Hectare 500N/-300E. Examination of their spatial distribution relative to one another and to other Summerville I features does not suggest the existence of any formal cemetery area, such as the one discovered during the 1977 excavations.

Orientation of the cranium toward the east (7 cases) or the southeast (4 cases) predominated over selection of other directions. Only two cases were oriented toward the north or northwest (see Appendix A). Body position was not so uniform: 6 individuals (3 adults and 3 infants) were extended supine, 3 adults were semiflexed supine, and 1 adult and 2 children were more tightly flexed supine (although not so tightly flexed as the Miller III individuals).

Each of the six adult burials located in the northwest corner of Hectare 500N/-300E had ceramic items as grave goods. One adult female (Burial 1) had three vessels placed by her head, and the remaining five possessed one whole or fragmented vessel part apiece. Burial 6 had only a large sherd in association. The three vessels with the other burials were incomplete. No other Summerville I burials were definitely associated with ceramic artifacts. One infant (Burial 1) in Hectare 500N/-400E was discovered with a very thin bone pin lying diagonally across the left thoracic region.

Of the nine burials assigned to the Summerville II or III periods, only two (Burials 3 and 4 in Hectare 400N/-300E) were clearly associated with a structure. The four individuals interred in Hectare 400N/-400E were judged to

have been contemporary, although not associated directly with Structure 1 (Burials 3 and 4), and Structures 3 and 4 (Burials 5 and 6) in that hectare. Seven of the nine were primary single interments. Two young children were represented only by very fragmented crania and teeth, deposited within small pits.

Orientation of the cranium toward the east or southeast was noted in each of the seven cases where this information could be determined. All but one of the articulated individuals were extended in a supine position within their burial pits; the exception was an adult female who lay semi-flexed (see Appendix A).

Only three of the nine individuals had associated artifacts. Burial 4 in Hectare 500N/-400E contained the cranium and teeth of a young child. Placed directly above these fragmentary remains were two vessels. The adult male in Burial 5 in Hectare 400N/-400E had been interred with a shallow bowl near his cranium. Burial 6 in the same hectare, another adult male who lay parallel to and quite near Burial 5, included the most distinctive artifact associations discovered in the 1979 sample. A terraced ceremonial bowl (see Chapter 1, this volume) was placed some 50 cm superior to the skull in the burial pit. Copper earspools had adorned his ears, were secured by bone pins. Four small triangular arrow points, possibly made by the same hand and unused, had been placed in the grave above his body. These items, particularly the bowl, distinguished this individual from his fellows as a person of some considerable importance of a supra-local as well as a local nature.

The seven burials designated as "Mississippian" in Appendix A resemble more closely the Summerville I, II, or III mortuary subsamples than they do the later Protohistoric, Summerville IV subsample. Five of these seven represent primary articulated interments rather than deposits of disarticulated remains. The two remaining burials consist of isolated clusters of teeth from an infant and an adolescent. Two of the burials include two individuals interred within the same pit, an occurrence not noted in the other subsamples.

The prevalent burial mode employed by the most recent Mississippian inhabitants of the site stands in sharp contrast to the single, primary, articulated interments employed by their predecessors. The seven burials (16.3 percent of the total burial sample) assigned to the Protohistoric (Summerville IV) occupation contained 64 individuals (62.1 percent of the total burial population). Only one of these interments (Burial 2 in Hectare 400N/-300E) contained a single articulated individual, an adult female aged between 20 and 39 years at death. All skeletal elements were represented except the skull. However, the presence of a dark stain in the cranial area of the burial pit suggests that this element had been originally included in the burial and had been removed at some later time. One burial (Burial 2) recovered in 1977 in the eastern sector of the site area displayed evidence suggestive of post-interment retrieval of selected elements, as did at least 5 of the Late Mississippian burials at site 1Gr2 located only a few miles downriver from the Lubbub Creek Archaeological Locality.

Three burial urns were recovered from the area of the site which displayed the greatest evidence of Protohistoric, Summerville IV occupation. Two of the urns were located beneath the floor of Structure 5 in Hectare

500N/-200E. The third was uncovered on the western periphery of Structure 3 in Hectare 500N/-300E. Eight subadult individuals were included in the three vessels (Appendix A). There were no associated artifacts other than the enclosing urns with these burials.

Clear articulation of skeletal elements was evident for only one (USN 1889, a child 3-4 years old) of the eight subadults, (although one (but not both) of the younger individuals in Urn 2 (USN 2260) and the single child in Urn 3 (USN 7404) could have been accomodated in their urns in that condition. The observed spatial distribution of their skeletal elements, however, argued against that occurrence. Cranial, pelvic, and appendicular elements predominated (with the exception of the hands and feet), but axial elements (ribs, vertebrae, clavicles, and scapulae) were less completely represented (see Appendix B). The two older individuals (USN 1886 in Urn 1 and USN 3650 in Urn 2) were represented by more skeletal elements (37 and 39, respectively, including fragmentary ribs) than were the younger individuals. The two infants in Urn 2 were the least complete (13 and 18 elements), and the more fragmented representation of the younger of the infants mirrored the general pattern of age-progressive anatomical completeness.

One possible explanation for this observed patterning is the differential preservation of the bones of infants and older individuals, the more fragile cortex of the former rendering them more vulnerable to post-depositional destruction (Angel 1967). The evidence, however, suggests that certain skeletal elements (e.g. the cranium and mandible, the larger long bones) carried stronger connotations of symbolically significant identification with the deceased individual, and were therefore selectively included in collections of processed remains destined for final deposition.

This latter conclusion is supported by data from the three remaining burials assigned to the Summerville IV occupation, all of which consisted of disarticulated bundles of selected skeletal elements. The smallest of these deposits of processed remains was Burial 1 from Hectare 400N/-300E, located near Burial 2 described above. Both burials were discovered immediately northeast of Structure 5, and the latter interment was intersected by the northeastern wall of this structure. Included in this bundle were the skull and long bones of a child age 7 to 9 years. The skull rested upon its base, and the long bones were arranged in two parallel stacks extending northwestward from it. Neither pelvic nor axial portions, nor extremities were present, nor were there any associated artifacts.

Burial 5 in the same hectare was a cache of carefully stacked adult calvaria covering the bundled disarticulated remains of a young adult female; these in turn overlay the calvarium of a young child. This burial was located at the extreme eastern central border of the hectare, just beyond the southern border of the mound. Nine adult individuals were represented by calvaria only: the superior portions of the frontal, parietal and occipital bones. No associated artifacts were recovered. The long axis of the cache ran from northeast to southwest.

Poor preservation of the bone has obscured any traces of deliberate severing of these portions from the inferior sections of the crania, but such is strongly suggested by the clearly patterned representation of these cranial elements. The absence of the corresponding temporal bones of these

individuals might be explained in part by their late fusion to the cranial vault; such fusion would not have been very far advanced in these younger adult individuals, aged 20 to 40 years at death. The delicate facial regions might have been lost to post-deposition decomposition. However, the complete absence of any trace of the frontal and occipital bones inferior to the level of the temporal lines cannot be so easily accounted for by these explanations because those regions in which separation has occurred consist of relatively thick bone. Deliberate removal of the absent cranial portions seems evident, perhaps to facilitate the stacking of concave vault sections in the manner noted during excavation.

The disarticulated postcranial remains were discovered only during final excavation of this feature in the osteology laboratory. Included were pelvic, axial, and extremity elements, as well as long bones of the appendicular skeleton, all neatly stacked in a compact bundle. As noted for the urn burials and Burial 1 discussed above, selection was clearly biased in favor of the larger bones. Those parts which included numerous "redundant" bones (e.g. the hands, feet, ribs, and vertebral column) were typically represented by a few of their larger elements (e.g. the feet by the talus and calcaneus).

A number of these postcranial bones displayed traces of burning which ranged from slight scorching of the cortex to pervasive blackening. The absence of calcification, warping, and cracking of the bones (with the exception of the right femur posterior shaft) suggests exposure to low heat shortly after the flesh had been removed (Buikstra and Swegle 1980). Deliberate cremation was not a common feature of Mississippian mortuary ritual in this region. Accidental contact with fire in the course of processing or storage before deposition seems the probable explanation.

None of the cranial vault fragments bore any trace of contact with fire. It could not be determined if any of them belonged to the young female, although such was certainly possible. The only fragment of cranial bone <u>inferior</u> to the vault region recovered from the entire mass was the gracile mastoid process of a right temporal of an adult discovered within the bundle of postcranial remains. The process displayed a thoroughly blackened lateral aspect, but no cracking or checking of the cortex. The evidence suggests that this fragment belonged to the young adult female.

Located some 130 meters to the north of Burial 5 and separated from it by the mound was Burial 9 in Hectare 500N/-300E. This large ossuary contained the remains of at least 43 individuals (Table 10). The use of the term "ossuary" here follows Ubelaker's usage (1974:8): "...those secondary deposits that probably represent the periodic redisposal of individuals which took place after a culturally prescribed number of years." This feature was located some 5 meters north of Structure 3, which contained one burial urn beneath it's floor. The long axis of the rectangular pit which contained the ossuary was oriented north-northeast, south-southwest, and lay roughly at a right angle to the orientation of the majority of the stacks of long bones within the deposit. No associated artifacts were recovered from this ossuary.

The patterned arrangement of these bones within their bundles and the bundles within the pit is clearly evident in Figure 1. The selection of skeletal elements for inclusion was similarly non-random and corresponded closely with the preferential selection of the larger, less "redundant" bones

TABLE 10

Demographic Profile of Burial 9 (USN 7480) Compared with Profile of Total Sample

	USN 7480		Total Sample	
	N	%	N	%
0-2 years	3	7.0%	13	12.6%
2-5 years	0	0.0%	11	10.7%
5-10 years	2	4.7%	5	4.9%
10-18 years	1	2.3%	4	3.8%
Adults	37	86.0%	70	68.0%

primarily from the appendicular skeleton noted in the urn burials and Burials 1 and 5, discussed above (see Table 11). In one aspect of this selection, however, Burial 9 differed radically from those features: only 16.3 percent of the ossuary population was represented by cranial elements. In that sense, Burials 5 and 9 may have existed as complementary elements within the Summerville IV mortuary program. This suggestion is not meant, however, to imply any immediate link between these two features with respect to the specific individuals contained within, and no particular evidence for such a connection has been detected. A second marked difference between these burials in the deposition of cranial elements is their retention as complete (rather than deliberately fragmented) anatomical elements in the ossuary (Burial 9) but not in the calvaria cluster (Burial 5).

The non-random patterning of skeletal elements in the ossuary was also evident at a third level of organization. Within each of the discrete stacks of bones evident in Figure 1, the uppermost levels contained almost exclusively post-cranial elements, whereas the lowest levels frequently consisted of the disarticulated, but anatomically more complete, remains of one or two individuals represented by pelvic, axial, and extremity elements as well as by the usual components of the appendicular skeleton. Not every stack included such an individual at its base, but every individual so represented occurred in such a location.

With respect to demographic composition, the ossuary was heavily biased in favor of adults (37 of 43 individuals, or 86.0 percent). The distribution of the 6 remaining individuals throughout the subadult age ranges displayed the age-progressive decline noted by Weiss (1973) for juvenile mortality in preindustrial populations: three infants, two children, and one adolescent. The total proportion of subadults to adults within this ossuary seems too low, however, o reflect the actual mortality experienced by this population.

The variability in mortuary treatment observed in these seven Protohistoric features generally mirrors that discussed by Sheldon (1974) in <u>The Mississippian-Historic Transition in Central Alabama</u>. Prior to Sheldon's thoughtful study, a disproportionate amount of investigative attention had been devoted to burial urn interments in this region, to the exclusion of contemporaneous alternative modes of mortuary disposal. He noted that primary extended burials may actually have been the preferred mode in some areas, and that multiple bundle burials frequently predominated in Protohistoric sites located along the Tombigbee and lower Alabama Rivers. Of the 64 individuals associated with that occupation in the Lubbub Creek Archaeological Locality, 61 had been interred in multiple bundles (2 urns, the ossuary, and the calvaria cache), all "processed" by disarticulation save for one young child in urn 2.

With respect to differential selection of skeletal elements for inclusion in these deposits, the Lubbub sample also conforms well to the pattern noted by Sheldon in such features: pairs of femora, tibiae, fibulae, humeri, radii, and ulnae (in the approximate descending order of frequency), with ribs, clavicles, scapulae, pelves, vertebrae, hands and feet occasionally included. Cranial elements were evidently accorded separate disposal at Lubbub, as evidenced by their very low representation within the ossuary and very high representation (in a further processed form) in the calvaria cache. This distribution differs markedly from Sheldon's observation that skulls were

TABLE 11

Relative Frequency of Skeletal Elements within Burial 9 (USN 7480)

Element	Right	Left	Total
Femur	34	36	70
Tibia	27	29	56
Fibula	min 30	min 28	min 58
Humerus	26	26	52
Radius	17	11	28
Ulna	14	14	28
Innominate	5	5	10
Temporal	6	6	12
Mandible	-	-	8
Talus	4	3	7
Calcaneus	4	3	7
Axis	-	-	2
Atlas	-	-	1

present for roughly 75 percent of the individuals placed in multiple bundles.

The arrangement of bones within both ossuary and calotte caches suggests that they were placed in the pits enclosed within containers manufactured from perishable materials, as Sheldon has suggested for the similar features which he discussed. Sheldon does not mention the differential spatial distribution of the more completely represented individuals (as was noted in Burial 9) within multiple bundle burials, but such information may not have been available to him in secondary sources.

Several distinctive Late Mississippian mortuary features at the nearby site 1Gr2 (mentioned previously in connection with the single primary Protohistoric interment recovered from Lubbub) resemble the multiple deposits of processed remains in the Lubbub Creek Archaeological Locality and numerous sites discussed by Sheldon. Burial 7 at 1Gr2 duplicated in miniature (n=6) the essential demographic, anatomical, and spatial features of the Lubbub Creek Archaeological Locality ossuary. Burial 1 contained cranial elements from a minimum of 18 individuals, along with a sparse inclusion of postcranial remains, some displaying evidence of burning (Hill and Smith 1975). The presence of facial, dental, and basicranial elements distinguishes this feature clearly from the calvaria cache at Lubbub, however, despite their superficial resemblance as primarily cranial deposits. Burial 8 contained the bundled remains of a single adult individual. A number of burials (14, 17, 19, 20, and 25) displayed evidence suggestive of processing of deceased individuals via primary interment with subsequent collection of desired skeletal elements (Hill 1979a). Two unusual deposits of incomplete postcranial remains (Burials 3 and 5) consist of those elements not commonly included in multiple bundle burials such as Burial 7 and the Lubbub ossuary.

Another small ossuary containing crania and long bones of six adults was discovered at site 1Pe1 in the course of salvage excavations near Heiberger on the Cahaba River some 30 miles east of Moundville (Hutchinson 1976). The long bones were stacked neatly and the crania were placed adjacent to them. Ceramic materials recovered from the site suggested a Late Mississippian occupation.

In his discussion of mortuary aspects of the Mississippian-Historic transition in central Alabama, Sheldon (1974) noted that certain modes of disposal of the dead were evidently continued essentially unchanged throughout the period of time under consideration: primary interments, usually extended but more rarely flexed, bundled remains, and single skulls interred in small pits. However, new modes of interment also appeared, most notably the deposition of selected skeletal elements of adults and, more commonly, subadults within large globular urns. Sheldon suggested that this mode possibly represented a further development of an earlier mode which featured inverted vessels or large sherds placed over the cranial region. Three burial urns, the later mode, were associated with the Summerville IV occupation in the Lubbub Creek Archaeological Locality.

The second new mode of interment featured the deposition of selected skeletal elements from multiple individuals, apparently enclosed within [illegible] made of perishable materials (as contrasted with the nonperishable [illegible] burial urns). This mode has not been reported from Mississippian [illegible] at either Moundville or sites in this region. Examples of this mode

at Lubbub include the ossuary and the calvaria cluster.

European incursions into western central Alabama in the Late Protohistoric and Early Historic times encountered the Choctaw tribe occupying the territories containing the pre- and protohistoric sites discussed above. Choctaw mortuary customs made a striking impression on the early ethnographic chroniclers, so much so that Swanton commented in his invaluable compilation, Source Materials for the Social and Ceremonial Life of the Choctaw Indians (1931:70), "This feature of ancient Choctaw culture was developed so strikingly that more attention is devoted to it by writers on the tribe than to any other native custom." Different writers noted slight regional or idiosyncratic variants, but agreed on the main features of this complex behavior set, outlined below.

The newly deceased person was placed on a high scaffold of poles erected near his house. The height of the scaffold and the skin or cloth wrappings of the body discouraged disturbance by predators during the period considered necessary for decomposition of soft tissues. When sufficient time had lapsed (usually three to four months) a mortuary priest was summoned by the family to complete processing of the remains. Romans (in Swanton 1931:173) described these priests as "A certain set of venerable old Gentlemen who wear very long nails as a distinguishing badge on the thumb, fore and middle finger of each hand..." In the presence of the family and other mourners, the priest ascended by a ladder to the scaffold, unwrapped the body and removed the flesh, which he burned. The bones he scraped clean with his long nails and presented in a bundle to the family. After a funeral feast, at which the scaffold was burned, the bones were transported inside a wooden or cane chest to the community mortuary temple or "Bone-house" set some distance away from the residential area. When the Bone-house became filled with chests, these were given final communal interment by the surviving family members in a large pit.

Detailed ethnographic data such as that reported by Swanton may prove useful in the elucidation of archaeological evidence, if analogies drawn are based upon carefully considered comparisons of the data. Following Binford's (1972) directive, a model of expected archaeological evidence was constructed and tested with data from the Protohistoric multiple and individual mortuary features in the Lubbub Creek Archaeological Locality.

Since initial processing (decomposition of soft tissues) was accomplished on scaffolds rather than by primary interment, graves intended for single articulated individuals would not be expected to be numerous at Choctaw (or proto-Choctaw) sites. Romans (in Swanton 1931:174) mentioned that suicides and enemies of the Choctaw were "buried under the earth as one to be directly forgotten and unworthy the [normal] ceremonial obsequies..." This mode of disposal would probably have served a relatively small proportion of the inhabitants of a typical Choctaw community.

Halbert (in Swanton 1931:186) quotes one informant as stating that the flesh stripped from the bones was buried, not burned. It seems possible that this particular feature may have varied locally. Those sites where it was buried would be expected to yield some evidence of that disposal: for example, pits containing skeletal elements not usually included in the chests removed to the Bone house.

The scaffolds constructed for initial decomposition would leave few distinct traces in the archaeological record, perhaps small areas of burned earth from the bark fires which were kept burning beneath the scaffold for four days and a few postmolds containing charred posts. The Bone-houses themselves might be distinguishable from domestic dwellings by their lack of hearths and domestic rubbish and (at least in some cases) the absence of containing walls on all four sides.

The communal deposits of chests of bones would provide the most distinctive contributions to the archaeological record. Although the wooden and cane chests would not be preserved, the configurations of the individual deposits of bones within the pit should suggest their original confinement within some sort of enclosing containers. The bones themselves would not display any marks suggestive of their cleaning, if Milfort (in Swanton 1931:174) was correct that the mortuary priests were permitted the use of no tools except their long fingernails for that task.

The demographic profile of these ossuaries should reflect to some degree the mortality profile of the communities which created them. Differential mortuary treatment for subadults is not specifically mentioned in the sources cited by Swanton. Nevertheless, it may have been practiced, as it was in many other groups.

When the data from the Protohistoric occupation in the Lubbub Creek Archaeological Locality are compared with this general model, a good correspondence for one feature is immediately evident. Burial 9 from Hectare 500N-300E matches in both form and content the expectations for an ossuary generated by ethnographic sources. Adult males and females are present in approximately equal numbers, and subadults, although underrepresented, are also present. Distinct clusters of bones are evident, and their spatial pattern suggests original interment within some sort of rectangular containers. The location of the ossuary only 5 m north of Structure 3 in that hectare may in fact not refute ethnographic testimony concerning the locations of communal cemeteries at some distance from the living community. The presence of a burial urn beneath the floor of that structure (evidently the usual place of deposition for such vessels at this site) suggests that it may predate by some degree the community which created the ossuary.

So far as the evidence of mortuary-related structures is concerned, numerous postmolds in the area of the site which evidenced Protohistoric occupation could not be assigned to any particular recognized structure. Some of them may well represent mortuary scaffolds.

The calvaria cluster (Burial 5, Hectare 500N-300E) does not correspond to any feature of the Choctaw mortuary program as described by Swanton's sources. It is possible that it predates the proto-Choctaw occupation (as has been suggested for the [illegible]). However, it does appear to complement the ossuary in one respect [illegible] almost entirely of cranial elements, and crania are [illegible] in the ossuary. Crania may have been removed from [illegible] for [illegible]

AD-A155 048 PREHISTORIC AGRICULTURAL COMMUNITIES IN WEST CENTRAL ALABAMA VOLUME 2 STU..(U) MICHIGAN UNIV ANN ARBOR MI DEPT OF ANTHROPOLOGY C S PEEBLES 1983 C-5861(79) 6/6

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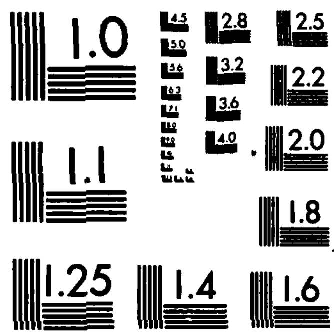

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DISCUSSION

Generally speaking, throughout the Woodland and Mississippian occupations in the Lubbub Creek Archaeological Locality, distinction of individuals via mortuary treatment apparently did not hold a prominent place in the social ceremonies of those populations. Not all individuals were accorded absolutely equal treatment, but within general age categories (adult vs. subadult) the differences do not suggest a highly visible system of social ranking such as that delineated at Moundville (Peebles 1974). Given the nature of the Lubbub settlement vis-a-vis Moundville, such an absence is not unexpected.

One Mature Mississippian individual (Burial 6, Hectare 400N/-400E) was accorded distinctive treatment in death, presumably reflecting his elevated status both within and beyond his resident community. The unusual terraced rectangular bowl interred above his head suggests some association with the ranked society at Moundville, as do his copper earspools. The triangular arrowpoints included in the grave sound a local technomic counterpoint to these extra-local socio-technic artifacts.

In the mortuary sample recovered in 1977 from the eastern sector of 1Pi33, one Early Mississippian adult male (Burial 20) had been accorded equally well defined distinction. Again, a combination of technomic (an ordinary ceramic vessel) and socio-technic (a copper plate engraved with a Southeastern Ceremonial Cult eagle dancer, plus twelve sheet copper hair plumes) items appeared. This person was attended in death by a second adult male and by pairs of articulated arms, legs, and feet placed over his body, surely socio-technic associations despite their original technomic functions.

As for the remainder of the 1979 mortuary sample from the Lubbub Creek Archaeological Locality, fewer than half of the burials included associated artifacts, all of a technomic nature. More adults than subadults possessed associations; the same was noted for the 1977 sample (Ensor and Hill 1979). Other features of mortuary treatment (burial facility, body position, and orientation) were generally non-distinctive, with the exception noted previously of the gradual abandonment from Woodland to Mature Mississippian times of the flexed in favor of the extended position for the body within the grave.

A survey of the sample as a whole reveals that the single most striking variation evident is the shift at the end of the Late Mississippian period from the individualized disposal of the dead, with little apparent processing of the body beyond its placement in a burial pit, to the collective deposition of selected skeletal elements representing groups of individuals whose remains had been more extensively manipulated. An apparent correlate of this collectivization was the abandonment of the practice of placing artifacts with the deceased.

Certain features of this collective treatment (the ossuary) accord well with ethnographic accounts of mortuary ceremonies of the Choctaw, the presumed descendants of the Summerville IV inhabitants at Lubbub. Other features (the burial urns, the calvaria cache) do not match the ethnographic accounts, although the former have been widely discovered in central Alabama Protohistoric contexts. Their co-occurrence with the ossuary (in a gross chronological sense) in the Lubbub Creek Archaeological Locality may be due to

actual micro-chronological variation within the Summerville IV component. The calvaria cache, which appears to complement the ossuary with respect to the disposal of cranial elements, may simply represent a local or regional variant of the mortuary customs described by Swanton's (1931) sources.

APPENDIX A

Tabulation of Age, Sex, Number of Individuals, Burial Form, Body Position, Orientation, and Cultural Period for Human Burials from the Lubbub Creek Archaeological Locality

KEY

Column 1 indicates the burial number assigned within the hectare designated at the head of each section. Individuals buried singly are numbered "1", "2", etc. Discrete individuals in multiple burials are designated "1A", "1B", etc. Conmingled individuals in multiple burials are not designated separately in this manner.

Column 2 indicates the USN (Unit Serial Number) assigned to the individual represented in Column 1.

Column 3 indicates the estimated age of the individual at death. Age ranges are given for all subadult individuals as well as for those adults where such estimations were possible.

Column 4 indicates the estimated sex of the individual(s) in the burial, by the following key:

UN = unknown
FE = female
MA = male
AL = both sexes

Column 5 indicates the total minimum number of individuals included in this burial.

Column 6 indicates the burial form, by the following key:

UN = unknown
AR = articulated
DI = disarticulated
IC = isolated cranium
BU = bundle

Column 7 indicates the position of the body, by the following key:

UN = unknown or inapplicable, in case of non-articulated remains
ES = extended supine
EP = extended prone
FL = flexed
SF = semiflexed (knee joints only)

Column 8 indicates the orientation of the cranium, with respect to grid north. Where this could not be determined, UN = unknown.

Column 9 indicates the cultural period to which the burial has been assigned, by the following key:

UN = unknown
Mi = Miller III
Su I = Summerville I
Su II/III = Summerville II/III
Su IV = Summerville IV (Protohistoric)
Ms = Mississippian (not assignable to a particular Summerville subphase)

APPENDIX A

Hectare	BURIAL NUMBER	USN	AGE	SEX	TOTAL N IN BURIAL	BURIAL FORM	BODY POSITION	ORIENTATION BY MAG N	CULTURAL PERIOD
300N/-300E	1	1381	Adult	FE	1	AR	ES	E	SU I
	2	1405	+30	MA	1	UN	UN	E	SU I
	3	1315	Adult	FE	1	AR	FL	N	Mi III
400N/-400E	1	1693	*	*	*	*	*	*	*
	2	1716	*	*	*	*	*	*	*
	3	2082	1-1.5	UN	1	AR	ES	SE	Su II/III
	4	2085	2-3	UN	1	AR	ES	SE	SU II/III
	5	2789	+30	MA	1	AR	ES	E	SU II/III
	6	2823	30-39	MA	1	AR	ES	E	SU II/III
400N/-200E	1A	1886	16-17	UN	3	DI	UN	UN	SU IV
	1B	1889	3-4	UN	3	AR	EP	UN	SU IV
	1C	1887	7-9	UN	3	DI	UN	UN	SU IV
	2A	3649	3-4	UN	4	DI	UN	UN	SU IV
	2B	3650	12-14	UN	4	DI	UN	UN	SU IV
	2C	3654	1.5-2	UN	4	DI	UN	UN	SU IV
	2D	**	.5-1	UN	4	UN	UN	UN	SU IV
300N/200E	1	2765	0-.5	UN	1	AR	ES	UN	SU I
	2	2943	0-.5	UN	1	AR	ES	ESE	SU I
400N/-500E	1	1966	Adult	UN	1	IC	UN	UN	UN
	2	2206	1-2	UN	1	UN	UN	E	UN
	3	2202	25-34	FE	1	AR	ES	S	MS
500N/-200E	1	8910	3-4	UN	1	IC	UN	SE	SU I
	2	***	35-44	FE	1	AR	FL	E	Mi

*No human skeletal material recovered.
**This individual was identified during laboratory analysis in Phase IV: no USN assigned.
***Recovered after Phase III excavations completed; no USN assigned.

APPENDIX A (continued)

Hectare	BURIAL NUMBER	USN	AGE	SEX	TOTAL N IN BURIAL	BURIAL FORM	BODY POSITION	ORIENTATION BY MAG N	CULTURAL PERIOD
600N/-400E	1	5247	4-5	UN	1	AR	FL	E	SU I
	2	5245	3-4	UN	1	AR	FL	E	SU I
400N/-300E	1	3449	7-9	UN	1	BU	UN	SE	SU IV
	2	4051	20-39	MA	1	AR	ES	ESE	SU IV
	3	4890	3-4	UN	1	IC	UN	UN	SU II/III
	4	5564	35-44	MA	1	AR	ES	SES	SU II/III
	5	6310	10 Adults 1 Child	AL	11	BU	UN	UN	SU IV
	6A	8123	30-39	MA	2	AR	ES	ESE	MS
	6B	8123	Adult	MA	2	AR	ES	ESE	MS
500N/-300E	1	4742	25-34	FE	1	AR	SF	N	SU I
	2	4772	*	*	*	*	*	*	*
	3	5457	35-44	FE	1	AR	SF	E	SU I
	4	5458	20-29	FE	1	AR	ES	E	SU I
	5	5488	40-49	MA	1	AR	ES	E	SU I
	6	5613	20-29	MA	1	AR	FL	SE	SU I
	7	5630	40-49	MA	1	AR	SF	SE	SU I
	8	7404	2-3	UN	1	DI	UN	UN	SU IV
	9	7840	(See table)	AL	43	BU	UN	UN	SU IV
	10	**	**	**	**	**	**	**	**
	11	9020	3-4	UN	1	AR	FL	UN	MS
	12	9480	Adult	MA	1	AR	SF	E	MS
	13	9491	12-15	UN	1	IC	UN	UN	MS
600N/-100E	1	1082	Adult	UN	1	UN	UN	UN	UN
500N/+200E	1	157	3-4	UN	1	UN	UN	UN	UN
500N/-400E	1	4077	0-.5	UN	1	AR	ES	NE	SU I
	2	4140	Adult	FE	1	AR	SF	ESE	SU II/III
	3A	4132	30-39	FE	2	AR	ES	SE	SU II/III
	3B	4132	0-.5	UN	2	UN	UN	UN	MS
	4	4385	5-7	UN	1	IC	UN	UN	SU II/III
	5	5038	.5-2	UN	1	IC	UN	UN	MS
	A1	7261	30-39	FE	2	AR	FL	N	MS
	A2	7261	4-5	UN	2	AR	UN	UN	MS

*Burial 2 contained no human skeletal material.
**Burial 10 was discovered during excavation to be part of Burial 9.

APPENDIX B

Tabulation of Skeletal Elements from Human Burials from 1Pi33

<u>KEY</u>

P = Bone is present but in very poor condition.

0 = Bone is absent.

1,2... = One (etc.) bone or tooth of this type is present in reasonably good condition.

Row 1 includes the superior portion of the cranium.

Row 2 includes the base of the cranium.

Row 5 includes the total number of teeth present from both jaws.

Row 9 will in most cases bear the notation "P," unless the ribs are complete enough to count.

Row 10 will indicate the minimum number of vertebrae recognizable in each of the three categories.

Row 12 is labeled "innominate" rather than pelvis, as the pubic and ischial portions of the pelvis were almost never preserved.

Rows 16 and 21 (hands and feet) will indicate the minimum number of bones identifiable from the three types which comprise these elements, considered in this tabulation as a single unit.

APPENDIX B

	Hectare 300N/-300E (USN)			Hectare 400N/-400E (USN)					
	B1 (1381)	B2 (1405)	B3 (1315)	B1 (1693)	B2 (1716)	B3 (2082)	B4 (2085)	B5 (2789)	B6 (2823)
Cranial Vault	1	1	1	*	*	1	1	1	1
Cranial Base	1	1	1	*	*	O	1	P	1
Maxilla	O	1	P	*	*	O	1	1	1
Mandible	1	1	O	*	*	1	1	1	1
Teeth	20	10	5	*	*	10	8	17	20
Clavicle (L)	O	O	O	*	*	O	1	O	1
Clavicle (R)	O	O	O	*	*	O	1	O	1
Scapula (L)	O	O	O	*	*	O	1	O	1
Scapula (R)	O	O	O	*	*	O	1	O	1
Sternum	O	O	O	*	*	O	O	O	O
Ribs	O	O	O	*	*	O	P	O	P
Vertebrae (C)	O	O	O	*	*	O	2	O	4
Vertebrae (T)	O	O	O	*	*	O	5	O	7
Vertebrae (L)	O	O	O	*	*	O	5	O	O
Sacrum	O	O	O	*	*	O	O	O	1
Innominate (L)	O	O	O	*	*	O	1	O	1
Innominate (R)	O	O	O	*	*	O	1	O	1
Humerus (L)	1	1	P	*	*	O	1	O	1
Humerus (R)	1	1	P	*	*	O	1	1	1
Radius (L)	1	O	P	*	*	O	1	O	1
Radius (R)	O	O	P	*	*	O	1	O	O
Ulna (L)	1	O	P	*	*	O	1	O	1
Ulna (R)	O	O	P	*	*	O	1	O	O
Hand (L)	O	O	O	*	*	O	O	O	O
Hand (R)	O	O	O	*	*	O	O	O	O
Femur (L)	O	O	O	*	*	O	1	1	1
Femur (R)	1	O	O	*	*	O	1	1	1
Patella (L)	O	O	O	*	*	O	O	O	1
Patella (R)	O	O	O	*	*	O	O	O	1
Tibia (L)	O	O	O	*	*	O	1	1	1
Tibia (R)	O	O	P	*	*	O	1	1	1
Fibula (L)	O	O	O	*	*	O	1	1	1
Fibula (R)	O	O	P	*	*	O	1	1	1
Foot (L)	O	O	O	*	*	O	2	O	O
Foot (R)	O	O	O	*	*	O	O	O	1

*No human skeletal material was recovered from these burials.

APPENDIX B (continued)

	Hectare 400N/-200E (USN)							Hectare 300N/-200E (USN)	
	B1A (1886)	B1B (1889)	B1C (1887)	B2A (3649)	B2B (3650)	B2C (3654)	B2D (*)	B1 (2765)	B2 (2943)
Cranial Vault	1	1	1	1	1	P	1	1	1
Cranial Base	1	1	1	1	1	0	1	1	1
Maxilla	1	1	1	1	1	0	0	1	1
Mandible	1	1	1	1	0	0	1	1	1
Teeth	19	22	20	20	9	0	7	4	9
Clavicle (L)	1	1	0	1	1	1	0	0	0
Clavicle (R)	1	1	1	1	1	1	0	0	0
Scapula (L)	1	P	0	0	1	1	0	0	1
Scapula (R)	1	0	1	0	1	0	1	0	1
Sternum	0	0	0	0	0	0	0	0	0
Ribs	P	P	0	P	P	P	0	0	1
Vertebrae (C)	5	2	0	0	3	0	0	0	4
Vertebrae (T)	0	4	0	7	7	7	0	0	8
Vertebrae (L)	3	0	0	3	3	0	0	0	3
Sacrum	1	P	0	P	P	0	0	0	0
Innominate (L)	1	1	0	1	0	0	1	0	1
Innominate (R)	1	1	1	1	1	0	1	0	1
Humerus (L)	1	0	1	0	1	1	1	0	1
Humerus (R)	1	0	1	1	1	1	1	0	1
Radius (L)	1	0	0	0	1	0	0	0	1
Radius (R)	1	P	1	0	1	P	0	0	1
Ulna (L)	1	0	1	0	1	0	0	0	1
Ulna (R)	1	0	1	1	1	0	0	0	1
Hand (L)	0	0	0	0	0	0	0	0	0
Hand (R)	0	3	0	0	0	0	0	0	0
Femur (L)	1	1	1	0	1	1	1	1	1
Femur (R)	1	1	1	1	1	1	1	1	1
Patella (L)	0	0	0	0	0	0	0	0	0
Patella (R)	0	0	0	0	0	0	0	0	0
Tibia (L)	1	0	0	0	1	1	1	0	1
Tibia (R)	1	P	0	0	1	1	1	0	1
Fibula (L)	1	0	0	0	1	1	1	0	1
Fibula (R)	1	P	0	0	1	1	1	0	1
Foot (L)	0	0	0	0	0	0	0	0	0
Foot (R)	0	0	0	0	0	0	0	0	0

*This individual was identified during laboratory analysis in Phase IV; no USN was assigned.

APPENDIX B (continued)

	Hectare 400N/-500E (USN)			Hectare 500N/-200E (USN)		Hectare 600N/-400E (USN)		Phase I Testing	
								Hectare 500N/-200E (USN)	Hectare 600N/-100E (USN)
	B1 (1966)	B2 (2206)	B3 (2202)	B1 (8910)	B2 (*)	B1 (5247)	B2 (5245)	B1 (157)	B1 (1082)
Cranial Vault	1	P	P	1	1	P	P	0	**
Cranial Base	0	0	P	1	1	P	P	0	**
Maxilla	0	0	P	0	0	P	P	0	**
Mandible	0	P	P	0	1	P	1	0	**
Teeth	0	6	6	0	1	34	6	20	**
Clavicle (L)	0	0	0	0	0	0	0	0	**
Clavicle (R)	0	0	0	0	0	0	0	0	**
Scapula (L)	0	0	0	0	0	0	0	0	**
Scapula (R)	0	0	0	0	P	0	0	0	**
Sternum	0	0	0	0	0	0	0	0	**
Ribs	0	0	0	0	P	P	P	0	**
Vertebrae (C)	0	0	0	0	1	P	P	0	**
Vertebrae (T)	0	0	0	0	3	P	P	0	**
Vertebrae (L)	0	0	2	0	0	P	P	0	**
Sacrum	0	0	P	0	0	0	P	0	**
Innominate (L)	0	0	P	0	1	P	0	0	**
Innominate (R)	0	0	P	0	0	P	0	0	**
Humerus (L)	0	0	P	0	1	P	P	0	**
Humerus (R)	0	0	P	0	1	P	P	0	**
Radius (L)	0	0	P	0	1	P	0	0	**
Radius (R)	0	0	P	0	1	P	0	0	**
Ulna (L)	0	0	P	0	1	P	0	0	**
Ulna (R)	0	0	P	0	1	P	0	0	**
Hand (L)	0	0	0	0	0	0	0	0	**
Hand (R)	0	0	0	0	0	0	0	0	**
Femur (L)	0	0	P	0	1	P	P	0	**
Femur (R)	0	0	P	0	1	P	P	0	**
Patella (L)	0	0	0	0	1	0	0	0	**
Patella (R)	0	0	0	0	0	0	0	0	**
Tibia (L)	0	0	P	0	1	P	P	0	**
Tibia (R)	0	0	P	0	1	P	P	0	**
Fibula (L)	0	0	0	0	1	P	P	0	**
Fibula (R)	0	0	0	0	1	P	P	0	**
Foot (L)	0	0	0	0	P	0	0	0	**
Foot (R)	0	0	0	0	0	0	0	0	**

*Recovered after *Phase III* excavations completed; no USN assigned.
**No skeletal material recovered because no features excavated in transects in testing program.

APPENDIX B (continued)

	Hectare 500N/-400E (USN)							
	B1 (4077)	B2 (4140)	B3A (4132)	B3B (4132)	B4 (4385)	B5 (5038)	B"A"1 (7261)	B"A"2 (7261)
Cranial Vault	1	1	1	P	O	O	1	1
Cranial Base	1	1	1	O	O	O	1	1
Maxilla	1	1	1	O	O	O	1	1
Mandible	1	1	1	O	O	O	1	1
Teeth	O	24	30	O	18	13	28	6
Clavicle (L)	1	O	P	O	O	O	O	O
Clavicle (R)	1	O	P	O	O	O	O	O
Scapula (L)	1	O	P	O	O	O	O	O
Scapula (R)	1	O	P	O	O	O	O	O
Sternum	O	O	O	O	O	O	O	O
Ribs	20	P	P	O	O	O	P	P
Vertebrae (C)	4	P	P	O	O	O	P	2
Vertebrae (T)	10	P	P	O	O	O	P	6
Vertebrae (L)	2	P	P	O	O	O	P	O
Sacrum	O	P	P	O	O	O	O	O
Innominate (L)	1	O	1	P	O	O	1	O
Innominate (R)	1	P	1	P	O	O	1	O
Humerus (L)	1	1	1	1	O	O	1	O
Humerus (R)	1	1	1	O	O	O	1	O
Radius (L)	1	1	1	1	O	O	1	O
Radius (R)	1	1	1	O	O	O	O	O
Ulna (L)	1	1	O	1	O	O	1	O
Ulna (R)	1	1	O	O	O	O	O	O
Hand (L)	O	P	P	O	O	O	P	O
Hand (R)	P	P	P	O	O	O	O	O
Femur (L)	1	1	1	O	O	O	P	P
Femur (R)	1	O	1	1	O	O	1	O
Patella (L)	O	O	O	O	O	O	O	O
Patella (R)	O	O	O	O	O	O	O	O
Tibia (L)	1	1	1	O	O	O	1	O
Tibia (R)	1	O	1	1	O	O	1	1
Fibula (L)	1	1	1	O	O	O	1	O
Fibula (R)	1	O	1	1	O	O	1	1
Foot (L)	1	1	1	O	O	O	1	O
Foot (R)	1	1	1	O	O	O	1	O

APPENDIX B (continued)

	Hectare 500N/-300E (USN)									
	B1 (4742)	B2 (4772)	B3 (5457)	B4 (5458)	B5 (5458)	B6 (5613)	B7 (5630)	B8 (7404)	B9 (7942)	B10 (----)
Cranial Vault	1		1	1	1	1	1	1	**	*
Cranial Base	1	*	1	1	1	1	1	1	**	*
Maxilla	1		1	1	1	1	1	1	**	*
Mandible	[illegible]		1	1	1	1	1	1	**	*
Teeth	[illegible]	*	15	22	2	22	13	23	**	*
Clavicle (L)	1	*	1	1	P	1	1	O	**	*
Clavicle (R)	1	*	1	1	P	1	1	O	**	*
Scapula (L)	1	*	1	1	P	1	1	O	**	*
Scapula (R)	1	*	1	1	P	1	1	O	**	*
Sternum	O	*	O	O	O	O	O	P	**	*
Ribs	P	*	P	P	P	P	P	P	**	*
Vertebrae (C)	5	*	P	P	P	P	P	P	**	*
Vertebrae (T)	7	*	P	P	P	P	P	P	**	*
Vertebrae (L)	3	*	P	P	P	P	P	P	**	*
Sacrum	P	*	P	1	P	P	P	O	**	*
Innominate (L)	1	*	1	1	P	1	P	P	**	*
Innominate (R)	1	*	1	1	P	1	P	P	**	*
Humerus (L)	1	*	1	1	1	1	1	1	**	*
Humerus (R)	1	*	1	1	1	1	1	1	**	*
Radius (L)	1	*	1	1	P	1	1	1	**	*
Radius (R)	1	*	1	1	P	1	1	1	**	*
Ulna (L)	1	*	1	1	P	1	1	1	**	*
Ulna (R)	1	*	1	1	P	1	1	1	**	*
Hand (L)	6	*	13	P	P	P	P	O	**	*
Hand (R)	9	*	17	P	P	2	P	O	**	*
Femur (L)	1	*	1	1	O	1	1	1	**	*
Femur (R)	1	*	1	1	1	1	1	1	**	*
Patella (L)	1	*	1	O	O	O	O	O	**	*
Patella (R)	1	*	1	O	O	1	O	O	**	*
Tibia (L)	1	*	1	1	1	1	1	1	**	*
Tibia (R)	1	*	1	1	O	1	1	1	**	*
Fibula (L)	1	*	1	1	1	1	1	P	**	*
Fibula (R)	1	*	1	1	O	1	1	P	**	*
Foot (L)	P	*	9	O	3	7	2	O	**	*
Foot (R)	P	*	10	O	2	5	2	O	**	*

*Burial 2 contained no human skeletal material; Burial 10 ?s discovered during excavation to be part of Burial 9.
**See Table 11.

APPENDIX B (continued)

	Hectare 500N/-300E (continued) (USN)			Hectare 400N/-300E (USN)						
	B11 (9020)	B12 (9480)	B13 (9491)	B1 (3449)	B2 (4051)	B3 (4890)	B4 (5564)	B5 (6310)	B6A (8123)	B6B (8123)
Cranial Vault	0	0	0	1	0	P	1	10	1	1
Cranial Base	0	0	0	0	0	0	1	P	1	1
Maxilla	0	0	0	P	0	0	0	0	1	1
Mandible	0	0	0	P	0	0	1	0	1	1
Teeth	0	0	11	23	0	1	4	0	9	6
Clavicle (L)	0	0	0	0	0	0	1	1	1	P
Clavicle (R)	0	0	0	0	0	0	1	1	1	P
Scapula (L)	0	0	0	0	1	0	1	1	1	P
Scapula (R)	0	0	0	0	1	0	1	1	1	P
Sternum	0	0	0	0	0	0	0	0	0	0
Ribs	0	0	0	0	P	0	P	P	P	P
Vertebrae (C)	0	P	0	0	P	0	4	P	P	P
Vertebrae (T)	0	P	0	0	P	0	6	P	P	P
Vertebrae (L)	0	P	0	0	P	0	3	P	P	P
Sacrum	0	0	0	0	P	0	0	1	P	P
Innominate (L)	1	P	0	0	1	0	1	1	1	1
Innominate (R)	1	P	0	0	1	0	1	1	1	1
Humerus (L)	0	0	0	P	1	0	1	1	1	1
Humerus (R)	0	P	0	P	1	0	1	1	1	1
Radius (L)	0	P	0	P	1	0	1	1	1	1
Radius (R)	0	P	0	P	1	0	1	0	1	1
Ulna (L)	0	P	0	P	1	0	1	1	1	1
Ulna (P)	0	P	0	F	1	0	1	1	1	1
Hand (L)	0	0	0	0	P	0	0	P	0	P
Hand (R)	0	0	0	0	P	0	P	P	P	[illegible]
Femur (L)	1	1	0	P	1	0	1	1	1	1
Femur (R)	1	1	0	P	1	0	1	1	1	1
Patella (L)	0	0	0	0	1	0	0	0	[illegible]	P
Patella (R)	0	0	0	0	1	0	0	1	[illegible]	[illegible]
Tibia (L)	1	1	0	0	1	0	1	1	1	1
Tibia (R)	1	1	0	0	1	0	1	1	1	1
Fibula (L)	1	1	0	0	1	0	1	1	1	1
Fibula (R)	1	1	0	0	1	0	1	1	1	1
Foot (L)	0	0	0	0	P	0	P	0	P	5
Foot (R)	0	0	0	0	P	0	0	0	P	6

END

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